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IAA (A-10000 Series) A84-12789 - A84-15904

AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES

(Supplement 172)

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in February 1984 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA)*.



Scientific and Technical Information Branch 1984
National Aeronautics and Space Administration
Washington, DC

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INTRODUCTION

Under the terms of an interagency agreement with the Federal Aviation Administration this publication has been prepared by the National Aeronautics and Space Administration for the joint use of both agencies and the scientific and technical community concerned with the field of aeronautical engineering. The first issue of this bibliography was published in September 1970 and the first supplement in January 1971.

This supplement to *Aeronautical Engineering -- A Continuing Bibliography* (NASA SP-7037) lists 409 reports, journal articles, and other documents originally announced in February 1984 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*

The coverage includes documents on the engineering and theoretical aspects of design, construction, evaluation, testing, operation, and performance of aircraft (including aircraft engines) and associated components, equipment, and systems. It also includes research and development in aerodynamics, aeronautics, and ground support equipment for aeronautical vehicles.

Each entry in the bibliography consists of a standard bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged by the first nine *STAR* specific categories and the remaining *STAR* major categories. This arrangement offers the user the most advantageous breakdown for individual objectives. The citations include the original accession numbers from the respective announcement journals. The *IAA* items will precede the *STAR* items within each category.

Six indexes -- subject, personal author, corporate source, contract number, report number, and accession number -- are included.

An annual cumulative index will be published.

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All publications abstracted in this bibliography are available to the public through the sources as indicated in the category sections. It is suggested that the bibliography user contact his own library or other local libraries prior to ordering any publication inasmuch as many of the documents have been widely distributed by the issuing agencies, especially NASA. A listing of public collections of NASA documents is included on the inside back cover

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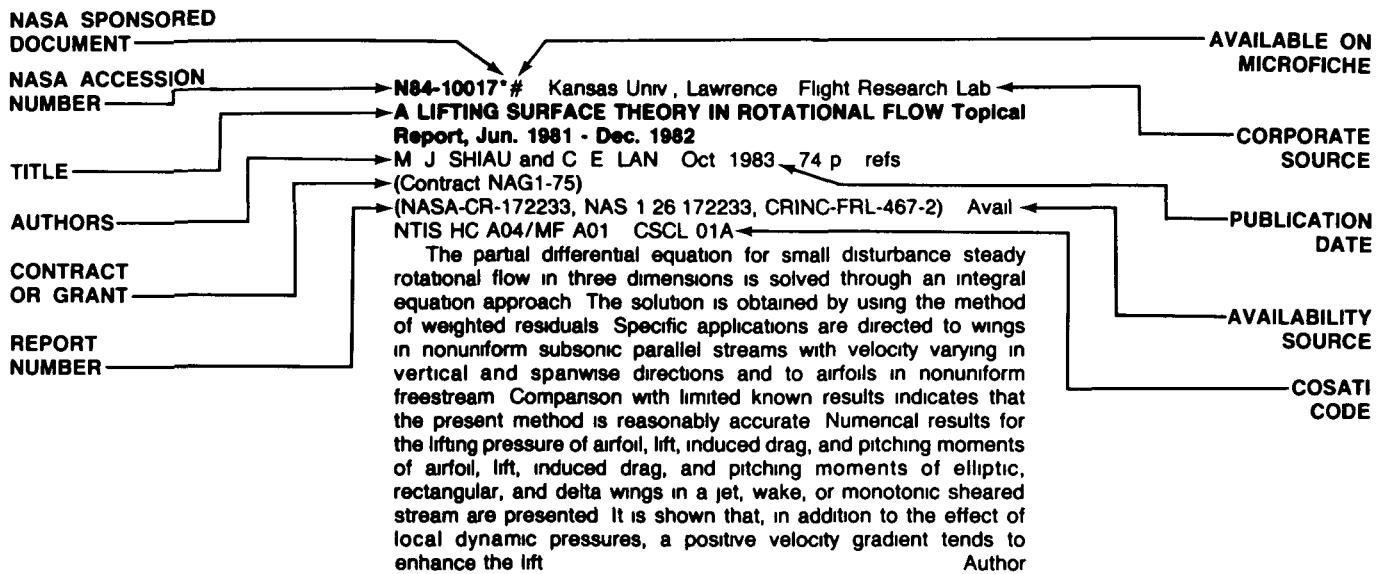
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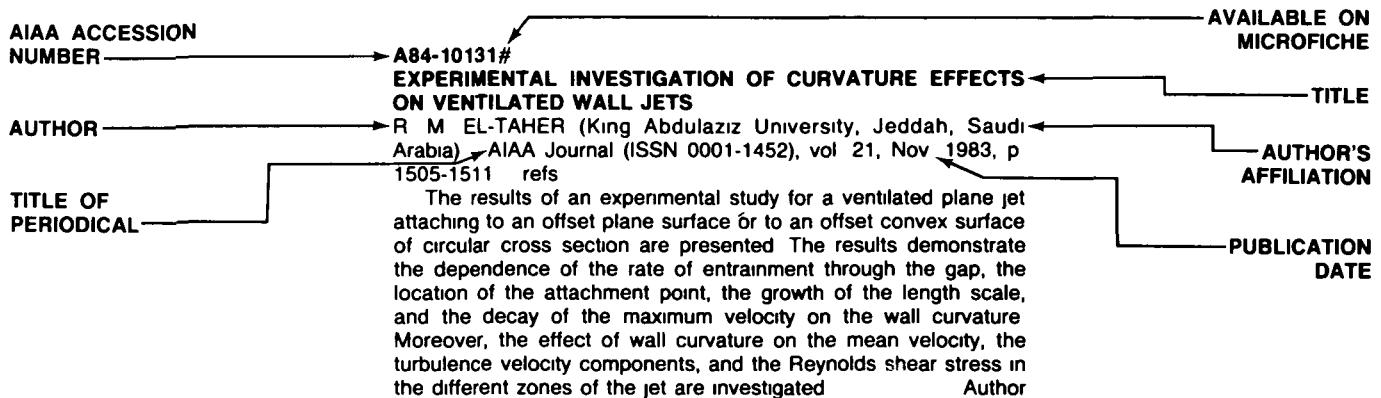
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AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 172)

MARCH 1984

01

AERONAUTICS (GENERAL)

A84-13389#

V/STOL FOR SEA CONTROL

S G KALEMARIS (Grumman Aerospace Corp, Bethpage, NY)
American Institute of Aeronautics and Astronautics, Aircraft Design,
Systems and Technology Meeting, Fort Worth, TX, Oct 17-19,
1983 7 p
(AIAA PAPER 83-2436)

The Falklands campaign has demonstrated that antiship cruise missiles cannot be countered adequately without airborne early warning (AEW). It is, therefore, vital that an AEW system be provided. Approaches for doing this are related to an employment of carriers, land-based aircraft, or an AEW system which can operate with and from the ships it supports. A primary performance requirement for an AEW system involves long endurance at high altitude. In addition to its AEW-related functions, the employed aircraft can also provide targeting information for U.S. ship-launched missiles. The considered capabilities could be incorporated into a V/STOL aircraft. The AEW aircraft could be based on surface combatants, dedicated V/STOL carriers, the ships of a convoy, or even a battleship. It is pointed out that the technology to build the considered AEW aircraft is in hand.

G R

A84-13805

THE RISE AND CHANGE IN AIRBORNE GRP

T R C BERRETT (Brownline, Ltd., Hounslow, Middx, England)
IN Reinforced Plastics Congress, 13th, Brighton, Sussex, England,
November 8-11, 1982, Proceedings London, British Plastics
Federation, 1982, p 33-36

The development of commercial aviation after the First World War is briefly discussed, and the increasing use of aircraft for the transportation of freight after the Second World War is considered. Attention is given to the influence of air cargo on airframe design, the introduction of the igloo made from glass-reinforced plastics (GRP) around 1960, the employment of GRP containers for air cargo, an evaluation of container materials, and the advantages and disadvantages of GRP for applications related to the carriage of goods by air. It is pointed out that GRP containers are heavier than aluminum alloy, but the intelligent use of carbon fiber and aramid fiber reinforcement can help redress the balance. There is currently a considerable shift away from GRP to aluminum alloy containers.

G R

A84-14251

THE AIRCRAFT DESIGNED BY THE MOSCOW AVIATION INSTITUTE OVER THE PAST FIFTY YEARS [LETATEL'NYE APPARATY, SOZDANNYE V MAI ZA 50 LET]

A A BADIAGIN and Iu V. MAKAROV Aviatsionnaia Tekhnika
(ISSN 0579-2975), no 2, 1983, p 3-15 In Russian refs

Over the period 1930-1980, nearly forty different aircraft were designed, built, and flight-tested by the students and staff of the Moscow Aviation Institute. These designs included a 2500-cu-m airship flown in 1931, a gyroplane, gliders, monoplanes and

biplanes, an air-cushion vehicle, helicopters, a bomber, a transport aircraft, sports aircraft, a pilotless aircraft for use in agriculture, and artificial satellites. The history of the development of the above aircraft, and their design and performance characteristics are briefly reviewed

V L

A84-14253

ESTIMATION OF THE FATIGUE LIFE OF THE STRUCTURAL ELEMENTS OF AN AIRFRAME FROM OPERATING AND REPAIR DATA [OTSENKA USTALOSTNOI DOLGOVESHCHNOSTI KONSTRUKTIVNYKH ELEMENTOV PLANERA SAMOLETA PO DANNYM EKSPLUATATSII I REMONTA]

V V BAKHOTSKII Aviatsionnaia Tekhnika (ISSN 0579-2975),
no 2, 1983, p 20-24 In Russian

A method for estimating the fatigue life of airframe components is proposed which takes into account both the number of flight hours and the number of flights (landings). The method is based on the assumption of the two-dimensional normal distribution of the vector (x_1, x_2) , where x_1 and x_2 are the logarithms of the number of flight hours and number of flights, respectively, prior to the appearance of a crack. The parameters of the vector distribution are determined from airframe inspection data obtained during service and repairs. The approach proposed here may be useful in planning preventive maintenance and repairs.

V L

A84-15406

PROBLEMS AND DEVELOPMENT TRENDS IN GENERAL AVIATION; SYMPOSIUM, FRIEDRICHSHAFEN, WEST GERMANY, MARCH 24, 25, 1983, REPORTS [PROBLEME UND ENTWICKLUNGSTENDENZEN IN DER ALLGEMEINEN LUFTFAHRT; SYMPOSIUM, FRIEDRICHSHAFEN, WEST GERMANY, MARCH 24, 25, 1983, VORTRAEGE]

Symposium sponsored by the Deutsche Gesellschaft fuer Luft- und Raumfahrt, Deutsche Gesellschaft fuer Ortung und Navigation, et al. Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1983, 368 p In German
(DGLR BERICHT 83-01)

The design of sport and touring aircraft is considered along with the design of high-performance gliders, the design of light helicopters, the problems of type certification, profile design for wings and propellers, the industrial manufacture of light aircraft by a fiber composite construction method, and the design of control forces and their adaptation in a flight test, taking into account the example of the DO 228. Attention is also given to the development of costs in general aviation, flight noise problems in general aviation, an analysis of incorrect human behavior in flight accidents and possibilities for influencing this behavior, and the limits of the principle 'see and avoid'. Other topics explored are concerned with systems for reducing the collision risk for general aviation, advances related to radio navigation aids for civil aviation, and functional airport installations as a necessary condition for aviation at present and in the future.

G R

01 AERONAUTICS (GENERAL)

A84-15412#

INDUSTRIAL MANUFACTURE OF LIGHT AIRCRAFT BY A FIBER COMPOSITE CONSTRUCTION METHOD [INDUSTRIELLE FERTIGUNG VON LEICHTFLUGZEUGEN IN FASERVERBUNDBAUWEISE]

H WILSER (Burkhardt Grob Flugzeugbau GmbH und Co, Mattsies, West Germany) IN Problems and development trends in general aviation, Symposium, Friedrichshafen, West Germany, March 24, 25, 1983, Reports Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1983, p 141-147 In German

The first aircraft of the world which was made entirely of plastics was a glider produced in 1957. A new era was introduced with the manufacture of the first gliders made of glass-fiber reinforced plastics (GFRP). German manufacturers, which in the 1960's adopted GFRP for the quantity production of gliders, could occupy a predominant position on the world market. A description is given of developments related to the production of GFRP aircraft by a West German company. The GFRP technology was adopted approximately 12 years ago. After the production of ordinary gliders, the manufacture of powered gliders was begun about two years ago. A powered aircraft with one engine and 2-3 seats is currently being tested. Attention is given to details concerning the manufacturing procedures employed for the production of aircraft consisting of GFRP

G R

A84-15413#

INDUSTRIAL MANUFACTURE OF LIGHT AIRCRAFT BY A FIBER COMPOSITE CONSTRUCTION METHOD. II [INDUSTRIELLE FERTIGUNG VON LEICHTFLUGZEUGEN IN FASERVERBUNDBAUWEISE. II]

C FISCHER (Rhein-Flugzeugbau GmbH, Moenchengladbach, West Germany) IN Problems and development trends in general aviation, Symposium, Friedrichshafen, West Germany, March 24, 25, 1983, Reports Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1983, p 149-163 In German

On the basis of developments regarding the employment of components made of fiber composites in light aircraft, it can be predicted that light powered aircraft of Group E will be available on the market in the foreseeable future. Attention is given to one of the first light aircraft made of fiber composite materials. After 15 years, the prototype of this aircraft is currently still airworthy. A description is provided of the developments in a German aerospace company which participated in the construction of the considered aircraft, taking into account other aircraft, made of fiber composite materials, and an experimental vehicle utilizing the ground effect. Aircraft wings made of fiber composites are considered along with the design of a rotor blade

G R

N84-12028# Iowa State Univ of Science and Technology,

Ames Engineering Research Inst

LOAD DEFLECTION CHARACTERISTICS OF INFLATED STRUCTURES Final Report

J R BAUMGARTEN Oct 1983 48 p refs

(Contract NSG-1605)

(NASA-CR-174585, NAS 1 26 174585, ISU-ERI-A84414) Avail

NTIS HC A03/MF A01 CSCL 01B

A single, closed form relationship to relate load to the deformed dimensions of the horizontal torus was developed. Wall elasticity was included in the analysis, and special care was taken to predict the final footprint area of the loaded structure. The test fixture utilized is shown. The tori used for the bulk of the testing were rubber inner tubes for a 32 and 160 pneumatic tire. The inner tube being tested was plumbed, to a mercury-filled manometer, which had a 50 inch measurement capacity, by use of a special adapter. The adapter fit over the valve stem and allowed air to be added from a shop-air source and to be bled through the standard valve mechanism. In this fashion, tests requiring the maintenance of a constant indication of air pressure could be run with little difficulty

S L

N84-12029*# National Aeronautics and Space Administration

Langley Research Center, Hampton, Va

CONTROLS, DISPLAYS, AND INFORMATION TRANSFER FOR GENERAL AVIATION IFR OPERATIONS

H P BERGERON, ed and J D SHAUGHNESSY, ed Washington Oct 1983 272 p refs Workshop held in Hampton, Va, 30-31 Aug 1982

(NASA-CP-2279, L-15649, NAS 1 55 2279) Avail NTIS HC

A12/MF A01 CSCL 01B

The purpose of the workshop was to review and evaluate the work performed under the NASA Single Pilot IFR (SPIFR) program, to highlight and disseminate major research findings, and to provide a forum for industry, universities, and government to interact and discuss the future thrust of research in the SPIFR program. The presentations selected represent key elements of the SPIFR program. These elements are classified into five disciplinary areas: program definition, controls, displays, information transfer, and research simulation facilities. Emphasis is also placed on aircraft accident investigation

N84-12030*# National Aeronautics and Space Administration

Langley Research Center, Hampton, Va

SINGLE PILOT IFR PROGRAM OVERVIEW AND STATUS

J D SHAUGHNESSY In its Controls, Displays and Information Transfer for Gen Aviation IFR Operations p 19-24 Oct 1983 Avail NTIS HC A12/MF A01 CSCL 01B

The history of the General Aviation Single Pilot IFR research program at NASA LaRC was discussed in general terms. The program objective, justification, and technical approach were given. The facilities used to conduct the research were discussed briefly. A general overview of recent accomplishments, present activities and near term plans were given

B W

N84-12050# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France)

SOME TRENDS IN AIRSHIP TECHNOLOGY DEVELOPMENTS

L B CREMA (Ist di Tecnologia Aerospaziale, Rome) and A CASTELLANI (Ist di Tecnologia Aerospaziale, Rome) 1982 12 p refs Presented at the 56th Meeting of the Struct and Mater Panel, London, 10-15 Apr 1983

(AGARD-R-717, ISBN-92-835-1458-0) Avail NTIS HC A02/MF A01

Recent advances in aerospace technology, and in particular the application of new materials and novel structures, have special relevance to the development of dirigibles. Significant reductions in structure weight, it is demonstrated, can be achieved through the use of, for example, carbon fiber composites. Corresponding improvements in operational performance are shown

Author

N84-12051# Synergy, Inc, Washington, D C

DEVELOP A NORMATIVE OR DESCRIPTIVE MODEL OF THE INTERNATIONAL/DOMESTIC CIVIL AVIATION INDUSTRY, VOLUME 3 Final Report

L H DYMOND, D L DENEMARK, and K E OLSONI 30 Sep 1982 382 p 3 Vol

(Contract F49642-81-C-0237)

(AD-A131878) Avail NTIS HCA17/MFA01 CSCL 01B

This appendix deals with the regulatory environment that the civilian air fleet has faced in the past and will likely face in the future. A brief history of the different regulatory agencies involved with civilian air travel is presented first, followed by a more in-depth analysis of the changing regulatory environment brought about by the Airline Deregulation Act of 1978, and its possible consequences on the structure of the civilian air fleet in the future

GRA

01 AERONAUTICS (GENERAL)

N84-12052# Synergy, Inc, Washington, D C
DEVELOP A NORMATIVE OR DESCRIPTIVE MODEL OF THE INTERNATIONAL/DOMESTIC CIVIL AVIATION INDUSTRY, VOLUME 2 Final Report

L H DYMOND, D L DENEMARK, and K E OLSONI 30 Sep 1982 89 p 3 Vol
(Contract F49642-81-C-0237)

(AD-A131877) Avail NTIS HCA05/MFA01 CSCL 01B

Volume 2 is composed of four major sections that provide the bulk of the analysis The first section deals with the regulatory framework, followed by a section dealing with the association framework, and a third section that deals with the industry components and demographics The fourth section addresses the financial performance of the industry GRA

N84-12053# Synergy, Inc, Washington, D C
DEVELOP A NORMATIVE OR DESCRIPTIVE MODEL OF THE INTERNATIONAL/DOMESTIC CIVIL AVIATION INDUSTRY. VOLUME 1: EXECUTIVE SUMMARY Final Report

L H DYMOND, D L DENEMARK, and K E OLSONI 30 Sep 1982 31 p 3 Vol
(Contract F49642-81-C-0237)

(AD-A131876) Avail NTIS HCA03/MFA01 CSCL 01B

Volume 1 of this report provides an overview of the US civil aviation industry, focusing on the immediate term and the future Its purpose is to provide a summary for identifying the implications of the projected future aircraft fleet mix on the civil/military airlift system in the 1990 time period The project is a direct result of the current turbulence in the airline industry and the uncertainty of the future airlift system The results of the study provide a foundation to support the development of an analytical modeling system of the Air Staff to project alternative future configurations of the civil air fleet given alternative scenarios of future conditions in the industry This particular phase of the effort focuses on four areas including the regulatory framework existing in the industry and that projected to exist in the future, the association network that has developed for the civil aviation industry and its importance to the development of future air industry structure, the components of the industry itself, including the number and types of airframes, engines, support functions within the industry such as travel agents, air freight forwarders, etc , and the industry demographics, including operating behavior, route competition, fares, etc GRA

N84-12054# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio
AFWAL FY82 TECHNICAL ACCOMPLISHMENTS Final Report

R S HOFF, JR Jun 1983 72 p
(AD-A131839, AFWAL-TR-83-0001) Avail NTIS HCA04/MFA01 CSCL 14B

This report contains highlights of significant technical achievements made during FY 82 The document exemplifies the broad range of R&D activities being undertaken within AFWAL and the significance of the technological contributions being made to enhance Air Force operational capabilities The accomplishments have been grouped by Laboratory to assist the reader in understanding the technologies covered The Air Force Wright Aerodynamical Laboratories are (1) Aero Propulsion Laboratory, (2) Avionics Laboratory, (3) Flight Dynamics Laboratory, and (4) Materials Laboratory GRA

N84-12055# Air Force Systems Command, Wnght-Patterson AFB, Ohio Foreign Technology Div
ACTA AERONAUTICA ET ASTRONAUTICA SINICA
28 Jul 1983 193 p Transl into ENGLISH of Hang Kong Xuebao (China), v 3, no 4, Dec 1982 108 p
(AD-A131828, FTD-ID(RS)-T-0266-83) Avail NTIS HCA09/MFA01 CSCL 20D

In this paper, the available state space aeroelastic models are reviewed, and several suggestions for improvement are proposed A new state space aeroelastic model is also proposed Flutter calculation is carried out on two types of wings These examples show that the new state space aeroelastic model is one of high accuracy and low order A method is presented by which the

modals can be automatically identified and the flutter point automatically determined during the course of flutter calculation using state space aeroelastic modeling GRA

N84-12056# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France)
INTEGRATION OF FIRE CONTROL, FLIGHT CONTROL AND PROPULSION CONTROL SYSTEMS

Loughton, England Aug 1983 194 p refs In ENGLISH and FRENCH Symp held in Toulouse, 17-20 May 1983 (AGARD-CP-349, ISBN-92-835-0335-X) Avail NTIS HC A09/MF A01

The potential and problems of integrating mission critical and flight critical systems are examined Fuel conservation, attack performance, combat survivability, and flight safety are addressed

N84-12072# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

SPECIAL COURSE ON SUBSONIC/TRANSonic AERODYNAMIC INTERFERENCE FOR AIRCRAFT

Loughton, England Jul 1983 286 p refs In ENGLISH and FRENCH Course held in Rhode-Saint-Genese, Belgium, 2-6 May 1983 and in Dayton, Ohio, 16-20 May 1983 (AGARD-R-712, ISBN-92-835-0332-5) Avail NTIS HC A13/MF A01

The emphasis of the course was on the configuration optimization in the transonic regime where both military and commercial aircraft must maneuver in an agile but stable manner The course material has been updated and was presented in a more structured fashion emphasizing the fluid dynamic interference mechanisms that are the keys to the optimization In addition some aspects of subcritical interference were also covered including those arising in the takeoff and landing phase of the flight with high lift devices deployed Background material is given describing the computational and testing The wide range of interference phenomena is covered arising in the optimization of both military and commercial aircraft starting from the simple airfoil and wing and extending to the complete configuration

N84-13138# National Aeronautics and Space Administration Langley Research Center, Hampton, Va

AN OVERVIEW OF AERODYNAMIC RESEARCH AND TECHNOLOGY REQUIREMENTS AS RELATED TO SOME MILITARY NEEDS

M L SPEARMAN Nov 1983 15 p refs
(NASA-TM-85691, NAS 1 15 85691) Avail NTIS HC A02/MF A01 CSCL 01B

Based on unclassified sources, a general review is presented of some military needs in light of the perceived USSR doctrine, force balances, inventory growth, inventory items, and current actions The Soviets appear to be attempting to increase their sphere of influence through economic and political control as well as possible military control of land, sea, air, and space To offset such possibilities, certain areas of deterrent needs that the Western World might pursue are suggested Particular emphasis is placed on the role of research and technology related to aerospace systems as part of the deterrent needs Author

N84-13139# National Aeronautics and Space Administration Langley Research Center, Hampton, Va

SOME THOUGHTS CONCERNING LARGE LOAD-CARRYING VEHICLES

M L SPEARMAN Nov 1983 25 p refs
(NASA-TM-85701, NAS 1 15 85701) Avail NTIS HC A02/MF A01 CSCL 01C

Some implications relative to combat operations and force sustainability into the twenty-first century are discussed The basic conjecture is that, sometime in the future, secure overseas basing may be denied to the United States by the Soviet Union or by unfriendly, unstable governments In that event, the support of future battle itself, may be conducted from the continental U.S and would introduce requirements for large, long-range, efficient,

01 AERONAUTICS (GENERAL)

and sometimes, fast air vehicles Some unusual design concepts and the technology requirements for such vehicles are suggested It is concluded that, while much of the required technology is already being pursued, further advanced should be expected and sought in improved aerodynamics, propulsion, structures, and avionics with a view toward increased efficiency, utility, and affordability

Author

N84-13140*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio

A REAL-TIME IMPLEMENTATION OF AN ADVANCED SENSOR FAILURE DETECTION, ISOLATION, AND ACCOMMODATION ALGORITHM

J C DELAAT and W C MERRILL Dec 1983 12 p refs Presented at the 21st Aerospace Sci Meeting, Reno, Nev, 9-12 Jan 1984

(NASA-TM-83553, E-1928, NAS 1 15 83553) Avail NTIS HC A02/MF A01 CSCL 01B

A sensor failure detection, isolation, and accommodation algorithm was developed which incorporates analytic sensor redundancy through software This algorithm was implemented in a high level language on a microprocessor based controls computer Parallel processing and state-of-the-art 16-bit microprocessors are used along with efficient programming practices to achieve real-time operation

Author

N84-13141*# Office National d'Etudes et de Recherches Aerospatiales, Paris (France)

LA RECHERCHE AEROSPATIALE, BIMONTHLY BULLETIN, NO. 1982-4, 209/JULY-AUGUST 1982

C SEVESTRE, ed Paris ESA Dec 1982 66 p refs Transl into ENGLISH of La Rech Aerospaiale, Bull Bimestriel (Paris) No 1982 Individual titles previously announced as A83-17315 through A83-17320

(ESA-TT-781, ONERA-1982-4) Avail NTIS HC A04/MF A01, Original ENGLISH version available from ONERA, Paris FF 55, Original version in FRENCH available from ONERA, Paris

A simple subgrid scale stresses model with homogeneous isotropic turbulence, the aeroelasticity of helicopter rotors in forward flight, aerofoils and blade tips for helicopters, regular or catastrophic evolution of steady flows depending on parameters, a quadratic programming algorithm, and holographic interferometry by non-silver film process are discussed

NW

N84-13142*# Office National d'Etudes et de Recherches Aerospatiales, Paris (France)

LA RECHERCHE AEROSPATIALE, BIMONTHLY BULLETIN, NO. 1982-5, 210/SEPTEMBER-OCTOBER 1982

C SEVESTRE, ed Feb 1983 89 p refs Transl into ENGLISH of La Rech Aerospaiale, Bull Bimestriel (Paris) No 1982-5, 210/Sep -Oct 1982 Individual titles previously announced as A83-23676 through A83-23680

(ESA-TT-785, ONERA-1982-5) Avail NTIS HC A05/MF A01, Original ENGLISH version available from ONERA, Paris FF-55, original FRENCH version available from ONERA, Paris

A hydrodynamic visualization laboratory, the influence of metallurgical factors on the fracture toughness of 7010 and 7050 aluminum alloys, electron beam energy branching in a gas mixture, aeroelastic equilibrium of a helicopter rotor with non-linear aerodynamic forces, and medium frequency linear vibrations of anisotropic elastic structure are discussed

NW

N84-13143*# Office National d'Etudes et de Recherches Aerospatiales, Paris (France)

LA RECHERCHE AEROSPATIALE, BIMONTHLY BULLETIN, NO. 1982-2, 207/MARCH-APRIL 1982

C SEVESTRE, ed Paris ESA Sep 1982 90 p refs Transl into ENGLISH of La Rech Aerospaiale, Bull Bimestriel (Paris) No 1982-2, 207/Mar-Apr 1982 p 61-144 Individual titles previously announced as A82-42527 through A82-42532 Sponsored by ESA

(ESA-TT-759) Avail NTIS HC A05/MF A01, Original version in ENGLISH available from ONERA, Paris FF 55, original report in FRENCH available from ONERA, Paris

Topics addressed include the following control losses on combat aircraft, pressure distributions on a wing, model of ammonium perchlorate self-degradation, internal stress in viscoplasticity, proton induced X ray emission, cryogenic operation of TZ ONERA/CERT wind tunnel, and an integral equation method for solving the exterior incompressible fluid-structure coupled problem

N84-13146*# Army Test and Evaluation Command, Aberdeen Proving Ground, Md

INTEGRATED LOGISTIC SUPPORTABILITY (AVIATION MATERIEL) Final Report

1 Sep 1983 43 p

(AD-A132367, TOP-7-3-507) Avail NTIS HCA03/MFA01 CSCL 15E

This TOP(Test Operations Procedures) presents a systematic method for conducting an integrated logistic supportability test in the developmental test environment Subelements of the logistic supportability test covered by this TOP are End item requirement, Supply support, Technical data/equipment publication, Support and test equipment, Manpower and personnel, training, and training devices, Transportation and Handling, and Facilities

Author (GRA)

N84-13147*# Federal Aviation Agency, Washington, DC Information and Statistics Div

CENSUS OF US CIVIL AIRCRAFT Annual Report

31 Dec 1982 307 p Sponsored in part by the FAA (PB83-252460, FAA-AMS-220) Avail NTIS HC A14/MF A01 CSCL 01C

Information about the U S civil aircraft fleet is presented Tables of air carrier aircraft are included as well as an inventory of registered aircraft by manufacturer and model General aviation aircraft are listed by state and county of the owner

GRA

02

AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces, and internal flow in ducts and turbomachinery

A84-13266

COMPUTER SOLUTIONS OF NAVIER-STOKES EQUATIONS FOR SHOCK WAVE TURBULENT BOUNDARY LAYER INTERACTIONS FAR AWAY FROM THE LEADING EDGE

V SWAMINATHAN and N S MADHAVAN (Indian Space Research Organization, Vikram Sarabhai Space Centre, Trivandrum, India) IN Numerical methods in laminar and turbulent flow, Proceedings of the Third International Conference, Seattle, WA, August 8-11, 1983 Swansea, Wales, Pineridge Press, 1983, p 221-231 refs

An accurate and efficient numerical algorithm for the solution of two-dimensional viscous compressible unsteady Navier-Stokes equations for obtaining flow parameters of oblique shock wave turbulent boundary layer interaction far away from the leading edge is presented The conditions at the upstream entrance boundary were kept fixed at the boundary layer values obtained either through detailed computations or by making use of separate empirical

relationships for the laminar sublayer and turbulent layer MacCormack's explicit time-splitting second-order accurate algorithm was made use of for integrating the governing equations in the required time and space intervals The results thus obtained for a typical case through the relevant computer program exhibit good comparison with those got by a calculation starting from the leading edge, testifying to the utility of the scheme described in the paper

Author

A84-13269**CALCULATION OF FLOW REATTACHMENT WITH VORTEX INTEGRAL EQUATIONS**

M RIBAUT (Brown, Boveri et Cie AG, Baden, Switzerland) IN Numerical methods in laminar and turbulent flow; Proceedings of the Third International Conference, Seattle, WA, August 8-11, 1983

Swansea, Wales, Pineridge Press, 1983, p 258-268 refs

A vortex integral equation method is applied to the calculation of the separated and reattaching flow past an airfoil. The method solves a mixed boundary condition problem in which the vortex strength or the distance of the separated vortex sheet to the profile surface is considered as explicit unknown. This provides a system of Fredholm equations of the first and second kind which can be solved by means of iteration and yields the shape and extension of the region underlying the separated flow and the vorticity distribution. Results of calculations for the flat and curved plate at different incidences are presented. The influence of vorticity diffusion on the location of the reattachment point is analyzed. Calculated velocity distributions are compared with the experiment

Author

A84-13273**AN ANALYSIS OF FLOW OVER A BACKWARD-FACING STEP BY AN ASSUMED STRESS MIXED FINITE ELEMENT METHOD**

S N ATLURI (Georgia Institute of Technology, Atlanta, GA) and

C-T YANG IN Numerical methods in laminar and turbulent flow, Proceedings of the Third International Conference, Seattle,

WA, August 8-11, 1983 Swansea, Wales, Pineridge Press, 1983,

p 302-316 USAF-supported research refs

In this paper, a detailed analysis of flow over a backward facing step is presented for two types of outlet boundary conditions, (1) traction free and (2) zero vertical velocity and zero horizontal traction, and for Re numbers up to 229. The computational scheme that is used is a mixed finite element method based on 'assumed-deviatoric-stress, -pressure, -velocity'. In this method, the final finite element equations involve the nodal velocities and the constant term in the pressure field in each element as unknowns. The convective acceleration term is treated via a standard Galerkin scheme

Author

A84-13278**FINITE ELEMENT ANALYSIS OF A SPLIT-FLOW PARTICLE SEPARATOR**

D S BREITMAN, E G DUECK (Pratt and Whitney Canada, Mississauga, Ontario, Canada), and W G HABASHI (Concordia University, Montreal, Canada) IN: Numerical methods in laminar and turbulent flow, Proceedings of the Third International Conference, Seattle, WA, August 8-11, 1983 Swansea, Wales, Pineridge Press, 1983, p 477-488 refs

This paper presents an analytical design method for inertial particle separators required for aviation gas turbines applications to helicopters. The solution of the flow field inside the separator is based on a Finite Element code for the radial equilibrium equation. The aerodynamic forces calculated are then used to predict the trajectories of solid particles of various sizes. Several separator designs are demonstrated and a very efficient final configuration is determined

Author

A84-13281**TIME-SPLIT FINITE ELEMENT METHOD FOR COMPRESSIBLE AEROFOIL TRAILING-EDGE FLOWS**

K SRINIVAS and C A. J. FLETCHER (Sydney, University, Sydney, Australia) IN Numerical methods in laminar and turbulent flow, Proceedings of the Third International Conference, Seattle, WA, August 8-11, 1983 Swansea, Wales, Pineridge Press, 1983, p 509-579 Research supported by the Australian Research Grants Committee refs

A time-split finite element method for solving the compressible Navier-Stokes equations in generalized coordinates is introduced. The method makes use of the group formulation which has been shown to be more economical and accurate than the conventional finite-element method for a related problem. The group formulation is combined with Lagrange elements which permits the directional mass and difference operators to be separated and an efficient three-level time-split computational algorithm to be constructed. The present procedure is made more economical by applying the finite element method in the (xi, eta) plane and using the isoparametric formulation to evaluate the transformation parameters only. The method is illustrated by computing the flow at the trailing-edge of an aerofoil, and the results are discussed.

Author

A84-13377#**FLOW VISUALIZATION FROM THE GROUND UP**

J P HUGHES, R E BRUMBY, and N BELEVTSOV (Douglas Aircraft Co, Long Beach, CA) AIAA, AHS, IES, SETP, SFTE, and DGLR, Flight Testing Conference, 2nd, Las Vegas, NV, Nov 16-18, 1983 11 p refs

(AIAA PAPER 83-2691)

A flow visualization technique, developed for in-flight application, is described and shown to be a useful tool for obtaining skin-friction patterns that can be inspected on the ground, obviating the need for a 'chase' aircraft. Patterns from flight and wind tunnel tests are compared and shown to agree favorably in regions which generally are removed from the influence of adjacent-surface interference effects. The comparison of surface streamline traces from a potential-flow analysis with the flight-obtained skin-friction lines indicates the highly viscous nature of the three-dimensional flow around the upswept afterbody of a commercial transport T-tail aircraft

Author

A84-13401**AERODYNAMIC CHARACTERISTICS OF BODIES WITH STAR-SHAPED CROSS SECTIONS AT MODERATE SUPERSONIC VELOCITIES [AERODINAMICHESKIE KHARAKTERISTIKI TEL SO ZVEZDOOBRAZNYH POPERECHNYH SECHENIEM PRI UMERENNYKH SVERKHZVUKOVYKH SKOROSTIakh]**

A L. GONOR, M A ZUBIN, A F MOSIN, N A OSTAPENKO, G S ULIANOV, and M P FALUNIN Moskovskii Universitet, Vestnik, Seria 1 - Matematika, Mekhanika (ISSN 0579-9368), Sept-Oct 1983, p 49-53 In Russian refs

Experimental results are presented on the total drag of bodies with star-shaped cross sections at Mach numbers of 2.04 and 3 and for a wide range of variation of geometric parameters. A comparison is made with the drag of cones and optimal bodies of revolution that are equivalent in length and middle-section area. It is shown that, in a wide range of aspect ratios, the star-shaped bodies have a smaller total drag. This aspect-ratio range is shown to increase with Mach number

B J

A84-13404**APPLICATION OF THE QUADRATURE FORMULA OF CUBIC SPLINES TO CALCULATE POTENTIAL FLOW PAST A SYSTEM OF AERODYNAMIC PROFILES [PRIMENENIE KVADRATURNOI FORMULY KUBICHESKIH SPLAINOV DLIA RASCHETA POTENTIAL'NOGO OBTEKANIIA SISTEMY AERODINAMICHESKIKH PROFILEI]**

A A ZAITSEV and A M KOMAROV Moskovskii Universitet, Vestnik, Seria 1 - Matematika, Mekhanika (ISSN 0579-9368), Sept-Oct 1983, p 69-74 In Russian refs

02 AERODYNAMICS

A84-13405

THE CENTER OF PRESSURE OF PYRAMIDAL BODIES [O TSENTR DAVLENIA PIRAMIDAL'NYKH TEL]

A I BUNIMOVICH and A V DUBINSKII Moskovskii Universitet, Vestnik, Seria 1 - Matematika, Mekhanika (ISSN 0579-9368), Sept-Oct 1983, p 74-77 In Russian

A method is developed for determining the shapes of pyramidal bodies whose center of pressure does not depend on the flow model or the angle of attack, the pressure on each face being constant. If the centers of pressure of each face coincide, the independence property is possessed by the body as a whole

B J

A84-13565*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
STABILITY OF SHOCK WAVES ATTACHED TO WEDGES AND CONES

M D SALAS (NASA, Langley Research Center, Hampton, VA) and B D MORGAN (Iowa State University of Science and Technology, Ames, IA) AIAA Journal (ISSN 0001-1452), vol 21, Dec 1983, p 1611-1617 refs

Previously cited in issue 06, p 799, Accession no A82-17876

A84-13574*# Pennsylvania State Univ, University Park
THREE-DIMENSIONAL FLOWFIELD INSIDE A LOW-SPEED AXIAL FLOW COMPRESSOR ROTOR

M POUAGARE, K N S MURTHY, and B LAKSHMINARAYANA (Pennsylvania State University, University Park, PA) AIAA Journal (ISSN 0001-1452), vol 21, Dec 1983, p 1679, 1680 (Contract NSG-3266)

Previously cited in issue 15, p 2347, Accession no A82-31964

A84-13576#

LASER DOPPLER VELOCIMETER MEASUREMENTS IN UNSTEADY, SEPARATED, TRANSONIC DIFFUSER FLOWS

J T SALMON, T J BOGAR, and M SAJBEN (McDonnell Douglas Research Laboratories, St Louis, MO) AIAA Journal (ISSN 0001-1452), vol 21, Dec 1983, p 1690-1697 Research sponsored by the McDonnell Douglas Independent Research and Development Program refs

Previously cited in issue 17, p 2873, Accession no A81-38079

A84-13578*# Maryland Univ, College Park

SUPersonic FLOW OVER A REARWARD FACING STEP WITH TRANSVERSE NONREACTING HYDROGEN INJECTION

H A BERMAN, J D ANDERSON, JR (Maryland, University, College Park, MD), and J P DRUMMOND (NASA, Langley Research Center, Computational Methods Branch, Hampton, VA) AIAA Journal (ISSN 0001-1452), vol 21, Dec 1983, p 1707-1713 refs

(Contract NCC1-41)

Previously cited in issue 15, p 2347, Accession no A82-31961

A84-13585*# Maryland Univ, College Park

THICKNESS AND CAMBER EFFECTS IN SLENDER WING THEORY

A PLOTKIN (Maryland, University, College Park, MD) AIAA Journal (ISSN 0001-1452), vol 21, Dec 1983, p 1755-1757 refs (Contract NCC1-41)

It is noted that the flow past thin slender wings with round leading edges can remain attached up to moderate values of angle of attack. In the low aspect ratio limit, the slender wing theory of Jones (1946) can therefore provide a simple analytical tool for studying this flow. First-order corrections to slender wing theory due to spanwise thickness and camber are developed. For wings of general planform, the validity and applicability of slender wing theory have recently been extended with the addition of chordwise and compressibility corrections by Levin and Seginer (1982). It is believed that similar corrections can be applied to the present results

C R

A84-13586#

CELLULAR PATTERNS IN POSTSTALL FLOW OVER UNSWEPT WINGS

D WEIHS and J KATZ (Technion - Israel Institute of Technology, Haifa, Israel) AIAA Journal (ISSN 0001-1452), vol 21, Dec 1983, p 1757-1759 refs

A model is presented which proposes a first-order estimate for calculating the relation between a rectangular wing aspect ratio and the number of cellular shapes appearing in the separated flow. The relation derived is based on the quasi-steady instability of two infinite parallel vortex lines, and the predicted and observed number of those cellular shapes are in good agreement. It is stressed, however, that further investigation is needed to determine the development of the wavy disturbance proposed here, the dynamic formation of these vortex rings, and their overall time-dependent nature

C R

A84-13589*# Princeton Univ, N J

TRANSIENT DECAY TIMES AND MEAN VALUES OF UNSTEADY OSCILLATIONS IN TRANSONIC FLOW

E H DOWELL (Princeton University, Princeton, NJ), P M GOORJIAN (NASA, Ames Research Center, Applied Computational Aerodynamics Branch, Moffett Field, CA), and T UEDA AIAA Journal (ISSN 0001-1452), vol 21, Dec 1983, p 1762-1764 refs

(Contract AF-AFOSR-81-0213A)

Kerlick and Nixon (1981) point out that if the time-marching solution is stopped before the transient is complete and the steady state is reached, then the incorrect conclusion may be reached that a change in the mean lift has occurred in response to the oscillating motion of the airfoil when in fact no such change has occurred. For a narrow Mach number range, however, the time for the transient to decay and for a steady state to be reached is extraordinarily long. What is more, for a very narrow range of Mach numbers, a nonzero mean value of lift can occur for an airfoil of symmetrical profile oscillations about a zero angle of attack. The reason why this nonzero average lift occurs only over a narrow range of Mach numbers has so far not been obtained

C R

A84-13592*# Delaware Univ, Newark

INLET FLOW DISTORTION IN TURBOMACHINERY - COMPARISON OF THEORY AND EXPERIMENT IN A TRANSONIC FAN STAGE

B S SEIDEL (Delaware, University, Newark, DE) and M D. MATWEY AIAA Journal (ISSN 0001-1452), vol 21, Dec 1983, p 1769, 1770 refs

(Contract NSG-3189)

Consideration is given to both velocity and temperature circumferential inlet distortions at upstream infinity (Seidel et al, 1980). The blade rows here are modeled as semiactuator disks, and losses and quasi-steady deviation angle correlations are included in the analysis. The governing equations are linearized, and the perturbations in stagnation pressure and stagnation temperature at upstream infinity are represented as Fourier series. The flow in the rotor is modeled as inviscid, one-dimensional, unsteady, and compressible; the flow is steady elsewhere. The deviation angles for the rotor and stator are taken to be functions of the relative inlet angle and Mach number, and use is made of the correlations contained in Johnson and Bullock (1965). It is assumed that the losses in relative stagnation pressure in the rotor and stator occur across the trailing edge. Boundary conditions applied at the various stations furnish the equations that make it possible to solve for the several quantities introduced in the linearization of the governing equations

C R

A84-13632#

AERODYNAMIC DESIGN OF ADVANCED ROTORS WITH NEW TIP SHAPES

J. J PHILIPPE (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) and A VUILLET (Societe Nationale Industrielle Aerospatiale, Division Helicopteres, Marignane, Bouches-du-Rhone, France) ONERA, TP, no 1983-119, 1983, 16 p refs (ONERA, TP NO 1983-119)

Progress in optimizing rotor performance at high speed is reported. Lift and high speed limits for conventional rotors are reviewed. Rotor blade section and twist optimization are discussed, showing results for flight envelope extension, the effect of blade section distribution on level flight performance, and the influence of blade nonlinear twist on rotor performance. Tip shape studies are presented, including preliminary acoustics results, for nonlifting and lifting rotors, swept tip aerodynamic optimization, tip taper, and fast forward flight. The relationship of acoustics improvements for thickness noise and impulsive noise to transonic flows is considered. The main conclusions of the studies are used to define the aerodynamic specification of a new blade adapted to high speed

CD

Author

A84-13633#

A NEW APPROACH USING VORTEX POINT METHOD FOR PREDICTION OF ROTOR PERFORMANCE IN HOVER AND FORWARD FLIGHT

B CANTALOUBE and S HUBERSON (Forum Europeen d'Helicoptere, 9th, Stresa, Italy, Sept 13-15, 1983) ONERA, TP, no 1983-120, 1983, 27 p refs (ONERA, TP NO 1983-120)

A numerical unsteady method used for computing 3-D incompressible flows around helicopter-rotors is presented. It is an extension of Rehbach's particles method to flow around surfaces with arbitrary motions. These surfaces are modeled by a surface doublet distribution, and the vortex sheet by a set of vortex carrying particles. Some examples of applications to rotors are presented with a look at both kinematic and dynamic aspects of the flow

Author

Author

A84-13639#

A SUBDOMAIN DECOMPOSITION TECHNIQUE AS AN ALTERNATIVE FOR TRANSONIC POTENTIAL FLOW CALCULATIONS AROUND WING-FUSELAGE CONFIGURATIONS

T H LE (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) (Gesellschaft fuer angewandte Mathematik und Mechanik, Conference sur les Methodes Numeriques en Mecanique des Fluides, 5th, Rome, Italy, Oct 5-7, 1983) ONERA, TP, no 1983-124, 1983, 8 p. refs (ONERA, TP NO 1983-124)

The reliability of transonic potential flow calculations on wing-body configurations using a subdomain decomposition technique is examined for severe flow conditions and realistic geometries. Two test cases are considered: the W(A)B(2) configuration of the RAE at a free-stream Mach number of 0.9 at an angle of attack of 1 deg, and the DFVLR/Garteur F 4 wing-body at a free-stream Mach number of 0.75 and angle of attack of 0.1 deg. The results show that the multidomain approach is robust

CD

Author

A84-13640#

COMPUTATION OF THREE-DIMENSIONAL TRANSONIC INVISCID FLOWS ON A WING BY PSEUDO-UNSTEADY RESOLUTION OF THE EULER EQUATIONS

CH KOECK (Matra, S A, Veizy-Villacoublay, Yvelines, France) and M NERON (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) (Gesellschaft fuer angewandte Mathematik und Mechanik, Conference sur les Methodes Numeriques en Mecanique des Fluides, 5th, Rome, Italy, Oct 5-7, 1983) ONERA, TP, no 1983-125, 1983, 9 p refs (ONERA, TP NO 1983-125)

A pseudo-unsteady method developed at ONERA for solving the Euler equations with an isoenergetic assumption, is applied to

the numerical computation of three-dimensional transonic inviscid flows past a wing. Unlike the methods based on the potential equation, this method yields exact solution of the steady Euler equations, in the case of isoenergetic flows, including weak solutions with shocks and vortex sheets. The continuity and momentum equations are integrated step by step in time using an explicit predictor-corrector scheme with a local time-step technique. This scheme is discretized directly in the physical space and stabilized by second and fourth order dissipative terms. The boundary conditions are treated using the compatibility relations theory. A mesh system of C-O type has been developed, which takes into account the existence of a round wing tip. Computations of flows on the ONERA M6 wing have been made in both lifting and non lifting cases. They are compared to full potential results and also to experiment. Computations made with two different artificial viscosity models are compared

Author

A84-13641#

A SECOND-ORDER LAGRANGIAN-EULERIAN METHOD FOR COMPUTATION OF TWO-DIMENSIONAL UNSTEADY TRANSONIC FLOWS

M. BORREL and PH MORICE (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) (Gesellschaft fuer angewandte Mathematik und Mechanik, Conference sur les Methodes Numeriques en Mecanique des Fluides, 5th, Rome, Italy, Oct 5-7, 1983) ONERA, TP, no 1983-126, 1983, 9 p refs (ONERA, TP NO 1983-126)

An improved numerical method, based on a Lagrangian-Eulerian approach, is presented for computing two-dimensional unsteady flows governed by Euler equations. This method uses both a finite volume technique and a finite element approximation. Numerical results are shown for steady and unsteady transonic flows in a channel

Author

A84-13647#

COMPRESSOR RESPONSE TO PERIODIC PRESSURE FLUCTUATIONS

J PAULON (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) (Tokyo International Gas Turbine Congres, Tokyo, Japan, Oct 23-28, 1983) ONERA, TP, no 1983-136, 1983, 6 p refs (ONERA, TP NO 1983-136)

Theoretical and experimental investigation of a low speed axial compressor with periodic modulated outlet area is described. Short response time pressure transducers mounted in the casing wall upstream of the rotor and downstream of the stator give the upstream attenuation of the modulated static pressure signal imposed downstream of the stator and the phase angle variation with the frequency of the modulator. A linearized theory based on the small perturbation assumption and a modified transfer function taking into account the memory of the fluid predicts quite correctly the test results in the 0-400 Hz frequency range

Author

A84-14255

A COMPUTER-AIDED STUDY OF ERRORS IN DISCRETE REPRESENTATIONS OF AN AIRFOIL PROFILE [AVTOVATIZATSIIA ISSLEDOVANIIA POGRESHNOSTI DISKRETNOGO ZADANIIA AERODINAMICHESKOGO OBVODA]

I I ITSKOVICH Aviatsionnaya Tekhnika (ISSN 0579-2975), no 2, 1983, p 28-33. In Russian refs

The use of a computer for estimating errors in the shape of airfoil profiles from the table of coordinates is discussed. An algorithm for the linear digital filtering of the coordinate errors of a plane gas-dynamic profile has been developed and implemented. To verify the efficiency of the linear digital filter, it has been used in designing turbocompressor blades. A resolution of 0.0001 mm and a filtering rate of 100 points per minute have been demonstrated

VL

02 AERODYNAMICS

A84-14264

CALCULATION OF THE BOUNDARY LAYER OF PROFILES FOR FLOWS WITH LAMINAR AND TURBULENT ZONES [O RASCHETE POGRANICHNOGO SLOIA NA PROFILIAKH PRI NALICHII ZON LAMINARNOGO I TURBULETNOGO REZHIMOV TECHENIIA]

V D SOVERSHENNYI and V A ALEKSIN *Aviatsionnaia Tekhnika* (ISSN 0579-2975), no 2, 1983, p 68-72 In Russian refs

A numerical method is presented for solving equations of the boundary layer of a profile for flows containing laminar, transition, and turbulent zones. Boundary layer characteristics are calculated for the transition region and for the whole profile, and the location of the separation point is determined. The results are compared with experimental data

V L

A84-14273

A LIMITING CASE OF A HYPERSONIC FLOW OF AN IDEAL GAS PAST A THIN TAPERED AIRFOIL [PREDEL'NYI SLUCHAI OBTEKANIIA TONKOGO ZAOSTRENNOGO PROFILIA GIPERZVUKOVYM POTOKOM IDEAL'NOGO GAZA]

N M MONAKHOV and V V MIGUNOV *Aviatsionnaia Tekhnika* (ISSN 0579-2975), no 2, 1983, p 104-106 In Russian

The method of rarefaction waves is used to investigate flows of a nonviscous non-heat-conducting gas with an attached shock wave and free-stream Mach tending to infinity. It is shown that the method provides sufficient accuracy while being relatively simple. The method can be used for solving both the direct and the inverse flow problem, but better results are to be expected in the case of the direct problem. The method is illustrated by examples

V L

A84-14386

THERMAL STUDY OF A WALL JET

M F SCIBILIA-COCHERIL and J LUAP (CNRS, Laboratoire d'Aerothermique, Meudon, Hauts-de-Seine, France) *Archiwum Mechaniki Stosowanej* (ISSN 0373-2029), vol 34, no 5-6, 1982, p 675-684 refs

The aim of this work is to study a wall jet at the chosen velocity of 2 m/s, blowing above a metal plate in a wind tunnel, the Reynolds number based on the height of the convergent exit is 533. At the transition point of the flow, in the test section, a line heat source is located, it consists of a tungsten wire heated, electrically fixed to the wall plate, normal to the flow, and placed successively at three different heights above the plate. In the first phase, the wire was heated continuously the temperature profiles obtained by a thermocouple showed a very rapid thermal diffusion. These temperature profiles are similar to turbulence rate profiles. The shift between the peaks which occurs is due to the partial absorption of the heat by the wall. In the second phase, the tungsten wire was heated intermittently by a quadratic signal and the thermal diffusion and the new velocity profile were studied considering the line heat source as the passive contaminant. The study may have numerous applications for problems as distribution of smoke leaving a chimney, heat transfer from a nuclear plant, effect of urban heating on the surroundings, heat transfer in certain installations of glass or steel works, meteorology (heat plumes)

Author

A84-14388

LOW-FREQUENCY TRANSONIC FLOWS PAST A THIN AIRFOIL

B K SHIVAMOGGI (Princeton University, Princeton, NJ) *Archiwum Mechaniki Stosowanej* (ISSN 0373-2029), vol 35, no 1, 1983, p 5-16 refs

Performance of a harmonically oscillating thin airfoil is studied by the methods of perturbations, local mean invariance, and reduction to a constant-coefficient equation. The methods of local mean invariance and the reduction to a constant coefficient are shown to give better results at Mach 1, while the method of perturbations is preferred in the supersonic regime

M S K

A84-14392

INVESTIGATION OF THE POSSIBILITIES OF TRAILING EDGE SHOCK WAVES INTENSITY REDUCTION BY MEANS OF THE EDGE GEOMETRY MODIFICATION

P DOERFFER (Polska Akademia Nauk, Instytut Maszyn Przytegowych, Gdansk, Poland) *Archiwum Mechaniki Stosowanej* (ISSN 0373-2029), vol 35, no 1, 1983, p 107-116 refs

Methods of transonic turbine blade shock waves weakening are proposed. A theoretical analysis of the methods based on an ideal gas model shows them to be effective. The analysis is carried out for a single trailing edge. The use of simple theoretical model requires an experimental verification. Theoretical and experimental results show good agreement except for the nearest vicinity of the edge. This allows for considering the method to be effective and justifies further investigation in cascade application. Author

A84-14690

GLOBAL PNS SOLUTIONS FOR SUBSONIC STRONG INTERACTION FLOW OVER A CONE-CYLINDER-BOATTAIL CONFIGURATION

P K KHOSLA and H T LAI (Cincinnati, University, Cincinnati, OH) *Computers and Fluids* (ISSN 0045-7930), vol 11, no 4, 1983, p 325-339 refs

(Contract N00014-79-C-0849)

The solution of the semi-elliptic or so-called parabolized Navier-Stokes equations is considered for large Reynolds numbers and subsonic flows with strong pressure interaction. Flow past a cone-cylinder-boattail configuration is investigated as a prototype of strong viscous-inviscid interaction. A global boundary-layer relaxation procedure is utilized for the formulation of the discrete boundary-value problem. The resulting marching procedure does not require a sub-layer type of approximation. Furthermore, the method does not restrict the step size in the marching direction and is free from any departure effects. Solutions with large recirculation regions are calculated

Author

A84-14727*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va

OBSERVATIONS AND IMPLICATIONS OF NATURAL LAMINAR FLOW ON PRACTICAL AIRPLANE SURFACES

B J HOLMES (NASA, Langley Research Center, Low Speed Aerodynamics Div, Hampton, VA) and C J OBARA (Kenton International, Inc, Hampton, VA) (International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1, p 168-181) *Journal of Aircraft* (ISSN 0021-8669), vol 20, Dec 1983, p 993-1006 refs

Previously cited in issue 20, p 3138, Accession no A82-40893

A84-14736#

COMPUTATIONS OF UNSTEADY TRANSONIC AERODYNAMICS USING PRESCRIBED STEADY PRESSURES

K -Y FUNG and A W CHUNG *Journal of Aircraft* (ISSN 0021-8669), vol 20, Dec 1983, p 1058-1061 refs

(Contract AF-AFOSR-81-0107, N0014-76-C-0182)

(AIAA PAPER 82-0956)

Previously cited in issue 18, p 2840, Accession no A82-37468

A84-14737*# Vigyan Research Associates, Inc, Hampton, Va

AN EXPLORATORY STUDY OF AREA-EFFICIENT VORTEX FLAP CONCEPTS

D M RAO (Vigyan Research Associates, Inc, Hampton, VA) *Journal of Aircraft* (ISSN 0021-8669), vol 20, Dec. 1983, p 1062-1067 NASA-supported research refs

The potential of planform modification and hinge-line relocation to improve the thrust efficiency of vortex flaps was experimentally investigated on a 60-deg cropped delta wing model. Spanwise segmentation of the flap, together with chord-tailoring of the segments, allowed the vortex to be maintained on the outboard flap surfaces to higher angles of attack. In addition, location of

the flap hinge aft of and underneath the wing leading edge generated substantial thrust from the vortex suction acting on the leading-edge lower surface A combination of these beneficial effects allowed the flap/wing area to be reduced from 11.4 percent of the continuous flap to 6.3 percent of segmented flap, essentially without detriment to the incremental lift-to-drag ratio due to flap addition in the lift coefficient range 0.5-0.7 based on the basic wing area.

Author

A84-14754

NOSE SHAPE EFFECTS ON TURBULENCE IN THE SEPARATED AND REATTACHED FLOW OVER BLUNT FLAT PLATES

T. OTA (Akita University, Akita, Japan) *Zeitschrift fuer Flugwissenschaften und Weltraumforschung* (ISSN 0342-068X), vol 7, Sept-Oct 1983, p 316-321 refs

Turbulence measurements were conducted in separated, reattached and redeveloped regions of a two-dimensional air flow over flat plates with blunt leading edges of various nose shapes. The nose shape effects on the turbulence characteristics in these flow regions were especially investigated. The three components of turbulent fluctuating velocity, the turbulent shear stress and the autocorrelation were measured. It is found that the nose shape has a strong influence on the turbulence features in the separated and reattached regions and even far downstream from the reattachment point.

Author

A84-14887

HYPersonic FLOW PAST A PLANAR BODY IN THE REGIME OF INTENSE RADIATIVE HEAT TRANSFER [GIPERZVUKOVOE OBTEKANIE PLOSKOGO TELA V REZHIME INTENSIVNOGO LUCHISTOGO TEPLOOBMEHA]

I. V. NEMCHINOV and S. P. POPOV *Akademii Nauk SSSR, Izvestia, Mekhanika Zhidkosti i Gaza* (ISSN 0568-5281), Sept-Oct 1983, p 126-129 In Russian refs

A numerical solution is obtained to the two-dimensional steady-state problem of the hypersonic flow of an inviscid radiating gas past a planar heat-insulated body with allowance for radiative energy transfer in the approximation of radiative heat conductivity. A heated zone arises around the body, the dimensions of this zone being an order of magnitude greater than the dimensions of the body. The heated-gas flow has a moderate Mach number ($M = 3-6$), and a narrow zone of strongly compressed gas is formed directly in front of the body. It is found that the hypersonic-flow pattern in the radiative regime is significantly different from that in the usual gasdynamic regimes.

B J

A84-14888

TRANSONIC FLOW OVER A CONVEX CORNER WITH A FREE STREAMLINE [O TRANSVUKOVOM OBTEKANII VYPUKLOGO UGLA SO SVOBODNOI LINIEI TOKA]

V. N. DIESPEROV *Akademii Nauk SSSR, Izvestia, Mekhanika Zhidkosti i Gaza* (ISSN 0568-5281), Sept-Oct 1983, p 130-137 In Russian refs

An asymptotic analysis of the Navier-Stokes equations at a Reynolds number tending to infinity is made for transonic gas flow over a convex corner. Attention is given to the limiting-flow case of a free streamline detached from the corner point at which acoustic velocity is attained. In the first approximation this flow is described by a self-similar solution to the Karman-Fal'kovich equation with a self-similarity exponent of $6/5$. It is shown that the favorable pressure gradient becomes infinite as the corner point is approached from the direction of the incoming flow.

B J

A84-14889

THE WAVE DRAG OF ELONGATED STAR-SHAPED BODIES AT MODERATE SUPERSONIC FLIGHT VELOCITIES [VOLNOVOE SOPROTIVLENIE UDLINENNYKH ZVEZDOOBRAZNYKH TEL PRI UMERENNYKH SVEKHZVUKOVYKH SKOROSTIAKH POLETA]

M. I. FOLLE *Akademii Nauk SSSR, Izvestia, Mekhanika Zhidkosti i Gaza* (ISSN 0568-5281), Sept-Oct 1983, p 146-151 In Russian refs

A theoretical study of the wave drag elongated star-shaped bodies at moderate Mach numbers is presented. It is shown that, for arbitrary combinations of the parameters, the star-shaped body is more efficient in terms of wave drag than an equivalent (in terms of midsection area and relative aspect ratio) axisymmetric body. It is also shown that it should be possible to reduce the wave drag of longitudinally optimal axisymmetric bodies.

B J

A84-14929

TWO TYPES OF SWIRLING GAS FLOWS [O DVUKH TIPAKH ZAKRUCHENNYKH GAZOVYKH POTOKOV]

A. F. SIDOROV *Prikladnaia Matematika i Mekhanika* (ISSN 0032-8235), vol 47, Sept-Oct 1983, p 754-761 In Russian refs

Two classes of exact solutions to steady three-dimensional equations of gas dynamics are obtained. These solutions are used to describe isentropic gas flows with two types of swirl in divergent axisymmetric channels. The effect of swirl on nozzle thrust is assessed.

B J

A84-14930

PROPAGATION OF UNSTEADY PERTURBATIONS IN A BOUNDARY LAYER WITH SELF-INDUCED PRESSURE [O RASPROSTRANENII NESTATSIONARNYKH VOZMUSHCHENII V POGRANICHNOM SLOE S SAMOINDUTSIROVANNYM DAVLENIEM]

V. B. GURIN and E. D. TERENTEV *Prikladnaia Matematika i Mekhanika* (ISSN 0032-8235), vol 47, Sept-Oct 1983, p 762-770 In Russian refs

Hypersonic flow past a flat plate which has a triangular vibrator mounted on it is analyzed in the case when the vibrator begins to oscillate harmonically in the unperturbed boundary layer. The plate and vibrator are assumed to be heat-insulated, and the dimensions of the vibrator and the oscillation frequency are such that the flow can be described by equations of a boundary layer with self-induced pressure. The transition of the pressure to a steady periodic regime is examined in the linear formulation, and the propagation of unsteady perturbations both upstream and downstream is investigated.

B J

A84-14939

METHOD FOR CALCULATING THE AERODYNAMIC CHARACTERISTICS OF BODIES ON THE BASIS OF INVARIANT RELATIONS OF THE THEORY OF LOCAL INTERACTION [METOD VYCHISLENII AERODINAMICHESKIKH KHARAKTERISTIK TEL NA OSNOVE INVARIANTNYKH SOOTNOSHENII TEORII LOKAL'NOGO VZAIMODEISTVIIA]

A. V. ANTONETS and A. V. DUBINSKII *Prikladnaia Matematika i Mekhanika* (ISSN 0032-8235), vol 47, Sept-Oct 1983, p 872-874 In Russian refs

The present study demonstrates the existence of relations between the aerodynamic characteristics of different forms of bodies of revolution invariant with respect to the flow model and the angle of attack. This approach is used to develop a method for calculating aerodynamic characteristics, which method is applied to bodies with a stepwise generatrix. It is shown that the proposed method makes it possible to obtain aerodynamic-force components that are close to those obtained on the basis of exact calculations of supersonic ideal-gas flow.

B J

02 AERODYNAMICS

A84-15080* Jet Propulsion Lab, California Inst of Tech, Pasadena

INVESTIGATION OF SUPERSONIC SEPARATED FLOW IN A COMPRESSION CORNER BY LASER DOPPLER ANEMOMETRY

E C. BAROTH (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, California, University, Berkeley, CA) and M HOLT (California, University, Berkeley, CA) Experiments in Fluids (ISSN 0723-4864), vol 1, no 4, 1983, p 195-203 refs

A single-component, computer-operated, three dimensional traversing laser Doppler velocimetry system was designed and constructed for a supersonic wind tunnel. The model was a 10 deg compression corner, providing an example of laminar boundary layer separation. Static pressure data and color schlieren photographs were taken. The Mach number was 2.42 and the Reynolds number was 213,000. The flow was seeded with submicron sized oil droplets. The trend of decreasing upstream influence with increasing Reynolds number was confirmed. Mean velocity profiles provided experimental evidence of reversed flow. Points of separation and reattachment were consistent with those determined by schlieren and pressure scans. The flow was of the laminar type until downstream of reattachment. Individual mean velocity and turbulence profiles, as well as velocity histograms are presented.

Author

A84-15201*# Massachusetts Inst of Tech, Cambridge
A COMPARISON WITH THEORY OF PEAK TO PEAK SOUND LEVEL FOR A MODEL HELICOPTER ROTOR GENERATING BLADE SLAP AT LOW TIP SPEEDS

R R FONTANA and J E HUBBARD, JR (MIT, Cambridge, MA) European Rotorcraft and Powered Lift Aircraft Forum, 9th, Stresa, Italy, Sept 13-15, 1983, Paper 33 p refs
(Contract NAG-1583, NAG2-182)

Mini-tuft and smoke flow visualization techniques have been developed for the investigation of model helicopter rotor blade vortex interaction noise at low tip speeds. These techniques allow the parameters required for calculation of the blade vortex interaction noise using the Widnall/Wolf model to be determined. The measured acoustics are compared with the predicted acoustics for each test condition. Under the conditions tested it is determined that the dominating acoustic pulse results from the interaction of the blade with a vortex 1-1/4 revolutions old at an interaction angle of less than 8 deg. The Widnall/Wolf model predicts the peak sound pressure level within 3 dB for blade vortex separation distances greater than 1 semichord, but it generally over predicts the peak SPL by over 10 dB for blade vortex separation distances of less than 1/4 semichord.

Author

A84-15202*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va

NUMERICAL PREDICTIONS OF RESIDENCE TIMES BEHIND A REARWARD FACING STEP WITH TRANSVERSE INJECTION

R C ROGERS and E H WEIDNER (NASA, Langley Research Center, Hampton, VA) Joint Army-Navy-NASA-Air Force Interagency Propulsion Committee, Combustion Meeting, 20th, Monterey, CA, Oct 17-21, 1983, Paper 18 p refs

A numerical investigation of the two-dimensional recirculation zone formed between a rearward facing step and a transverse hydrogen jet in a supersonic flow is presented. Calculations were made using an elliptic flow computer code with a time-relaxation finite difference integration algorithm. Cases were examined for jet static pressures between 2 and 5 times mainstream with jets located 3 to 7 step heights downstream of the step. Nominal mainstream flow conditions were Mach 2.4 air at 1 atm pressure and 1000 K (1800 R) static temperature. Results in the form of mean properties in the recirculation zone and residence time are presented. Calculations of the decay of hydrogen mass from the steady state are presented for selected cases. The combustion potential for each case is assessed by comparison of computed conditions in the recirculation zone with the results from a well-stirred reactor theory.

Author

A84-15255#

PRELIMINARY STUDY OF OIL-FLOW TECHNIQUE AND SEPARATED-FLOW IN HYPERSONIC SHOCK TUNNEL

S LI, Z YANG, and X WANG (Chinese Aerodynamic Research and Development Center, People's Republic of China) Acta Aerodynamica Sinica, no 3, 1983, p 55-63 In Chinese, with abstract in English refs

This paper presents the preliminary results of a study on oil-flow technique and turbulent boundary layer separation ahead of a cylinder in a hypersonic shock tunnel. The tests were carried out in a 0.6m shock tunnel. The free stream conditions of the nozzle exit are $M = 7.94$, $Re/L = 2.79 \times 10^6$ to the 7th (1/m). The tunnel test time is about 7ms. Test results are discussed and compared with the foreign results.

Author

A84-15257#

A NEW METHOD FOR CALCULATING THE PRESSURE DISTRIBUTION OF SUPERSONIC THIN WING

G HUANG (China Aerodynamic Research and Development Center, People's Republic of China) Acta Aerodynamica Sinica, no 3, 1983, p 78-82 In Chinese, with abstract in English refs

A new method for calculating the pressure distribution of supersonic thin wings is presented. The scatter error in pressure distribution calculations with Middleton's (1964) method is shown to be due to the two-dimensional value given to the initial lifting pressure coefficient of the partial grid elements along the subsonic leading edge. A reasonable value for the initial lifting pressure coefficient is deduced with supersonic conical flow theory. The scatter error of the pressure distribution is thereby largely reduced, while the speed computation remains the same as in Middleton's method. The computer time needed is much less than with Woodward's method. The present method is therefore suitable for calculating the supersonic pressure distribution of complex configurations.

CD

A84-15259#

THE ENGINEERING COMPUTATIONAL METHOD FOR THE PRESSURE AND HEAT TRANSFER DISTRIBUTION OF SUPERSONIC TURBULENT FLOW AT A TWO-DIMENSIONAL COMPRESSION CORNER

J LI (China Aerodynamic Research and Development Center, People's Republic of China) Acta Aerodynamica Sinica, no 3, 1983, p 89-94 In Chinese, with abstract in English refs

Supersonic turbulent separated flow at a two-dimensional compression corner is considered as attached flow on the equivalent compression surface. This surface is composed of a flat plate before separation, a zero-u line in the region of counterflow, and a wedge behind reattachment. An engineering computational method using Stollery's (1974) formula for determining the pressure and heat transfer distribution of supersonic turbulent flow on a wedge is given. Computational results are compared with experimental data, showing good agreement.

CD

A84-15260#

CALCULATIONS OF TWO-DIMENSIONAL UNSTEADY TRANSONIC FLOWS OVER AEROFOILS

H LU and J ZHANG (China Aerodynamic Research and Development Center, People's Republic of China) Acta Aerodynamica Sinica, no 3, 1983, p 95-99 In Chinese, with abstract in English refs

A numerical calculation method for solving the two-dimensional, inviscid, unsteady transonic, small perturbation equation using an alternating-direction implicit finite difference algorithm is presented. Test calculations on steady and unsteady transonic flows have shown the method to be efficient and economical. The method can be used to calculate airfoil for oscillating airfoils and to investigate shock waves and their movements in the flow field. In the procedure, an infinite physical region is transformed into a 2×2 rectangular computational region in the Cartesian coordinate system. The uniform computational mesh is divided into computational regions and the governing equation is discretized into a simple algebraic equation system.

CD

A84-15411#

**PROFILE DESIGN FOR WINGS AND PROPELLERS
[PROFILAUSLEGUNG FUER TRAGFLUEGEL UND PROPELLE]**

A QUAST and K H HORSTMANN (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer Entwurfs-Aerodynamik, Brunswick, West Germany) *IN* Problems and development trends in general aviation, Symposium, Friedrichshafen, West Germany, March 24, 25, 1983, Reports Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1983, p 107-138 In German refs

It has now become customary to develop profiles for wings and propellers for a given employment of the aircraft. This is possible because methods and computers are available to study an entire series of variants in a comparatively short time. The basic viewpoints for profile design are presented. It is shown that laminarization has its advantages in almost all cases, including the design of a turbine blade and the design of the profile of an airliner. The requirements which profiles have to satisfy are discussed along with the possibilities for increasing lift on profiles. Attention is given to friction-related drag, and drag related to pressure conditions. The effect of fouling on laminar profiles is also considered

G R

A84-15763

**A STUDY OF STRESSES ON THE SURFACE OF A PLANE OBSTACLE IN AN UNDEREXPANDED JET OF A RAREFIED GAS
[ISSLEDOVANIE NAPRIAZHENII NA POVERKHONOSTI PLOSKOI PREGRADY, OBTEKAEMOI NEDORASSHIRENNOI STRUEI RAZRIAZHENNOG GAZA]**

B F PANOV Leningradskii Universitet, Vestnik, Matematika, Mekhanika, Astronomiia (ISSN 0024-0850), Oct. 1983, p 78-83 In Russian refs

An experimental study has been made of the pressure and tangential stresses on the surface of a plane obstacle in the path of a strongly underexpanded air jet issuing from a sonic nozzle. It is shown that the relationship between the maximum value in stress distribution and the degree of rarefaction, which varies both with the gas pressure in the precombustion chamber and with the distance between the nozzle and the obstacle, is determined by the Knudsen number. The latter is derived from the gas parameters behind the shock wave and its departure from the obstacle. Empirical formulas for calculating tangential and normal stress distributions at the obstacle surface are presented

V L

A84-15854#

COMPUTATION OF THREE-DIMENSIONAL VISCOUS FLOWS ON TRANSONIC WINGS BY BOUNDARY LAYER-INVISCID FLOW INTERACTION

M LAZAREFF and J C LE BALLEUR (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) *La Recherche Aerospaciale* (English Edition) (ISSN 0379-380X), no 3, 1983, p 11-29 Research sponsored by the Societe Nationale Industrielle Aerospaciale refs

A three-dimensional numerical method for computing viscous flows on transonic wings is presented. This method provides a coupled solution to the full potential equation using a nonconservative relaxation technique with a three-dimensional integral method for the laminar-turbulent boundary layer. The interaction is achieved by the Defect Formulation with a transpiration velocity at the wall. The strong coupling on the wing, without separation, is reached by a simple empirical under relaxation. The method has been experimented on using the ONERA M6 and DFVLR F4 wings at supercritical speed. Good robustness in presence of very small separated areas is maintained by extrapolation. A significantly improved agreement between theory and experiment, when compared with the potential approximation is achieved especially on the F4 wing, even though the standard reached in two-dimensional methods is not yet attained

Author

A84-15855#

CALCULATION OF TRANSONIC FLOWS AROUND WING-FUSELAGE COMBINATION BY A SUBDOMAIN DECOMPOSITION APPROACH

T H LE (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) *La Recherche Aerospaciale* (English Edition) (ISSN 0379-380X), no 3, 1983, p. 31-42 refs

A subdomain decomposition approach is presented for computing transonic flows based on the finite difference solution of the full potential equation in non-conservative form. This approach employs Schwartz' alternating method as an interconnecting technique. The principle of subdomain decomposition is set forth along with the grid techniques employed. The application of this approach to transonic flow calculations around a wing-fuselage combination is demonstrated

Author

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SUBSONIC/TRANSONIC AERODYNAMIC INTERFERENCE FOR AIRCRAFT: INTRODUCTORY REMARKS

H YOSHIHARA *In AGARD Spec Course on Subsonic/Transonic Aerodyn Interference for Aircraft* 5 p Jul 1983 Avail NTIS HC A13/MF A01

These introductory remarks provide examples of important subsonic and transonic fluid dynamic mechanisms that make up interference concepts used in aircraft optimization. The rationale for the lecture topic selection and the course outline are then given

Author

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COMPUTATIONAL METHODS FOR SUBSONIC AND TRANSONIC AERODYNAMIC DESIGN

J W SLOOFF *In AGARD Spec Course on Subsonic/Transonic Aerodyn Interference for Aircraft* 40 p Jul 1983 refs Avail NTIS HC A13/MF A01

An overview is provided of computational methods that can be used in solving the design problem of aerodynamics, i.e., the problem of finding the detailed shape of (parts of) configurations of which the gross geometric characteristics have already been determined in a preliminary, overall design process, and that, subject to certain constraints, have to meet given aerodynamic requirements. Attention is focussed on methods for solving the classical inverse problem of aerodynamics and on approaches using optimization techniques. Both methods limited to subsonic flow utilizing panel method technology as well as methods based on finite difference/volume formulations for compressible, transonic flow are covered. In conclusion a discussion is presented of the relative merits of the various computational approaches to the problem of aerodynamic design

Author

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SUBSONIC/TRANSONIC VISCOUS INTERACTIONS

H YOSHIHARA *In AGARD Spec Course on Subsonic/Transonic Aerodyn Interference for Aircraft* 14 p Jul 1983 refs Avail NTIS HC A13/MF A01

Significant viscous interactions arising at transonic cruise and maneuver conditions and low speed/high lift conditions are described for airfoils and swept wings. Consequences on the performance and stability of fighter and airlift aircraft are briefly sketched. Computational methods using the integral boundary layer/wake equations are then described in a narrative fashion.

Author

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TRANSONIC AIRFOIL DEVELOPMENT

R T WHITCOMB *In AGARD Spec Course on Subsonic/Transonic Aerodyn Interference for Aircraft* 9 p Jul 1983 refs Avail NTIS HC A13/MF A01 CSCL 01A

This lecture consists of three parts, in which discussions are presented of the current state of development of transonic or supercritical airfoils designed for fully turbulent boundary layers

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on the surfaces, previous research on subcritical airfoils designed to achieve laminar boundary layers on all or parts of the surfaces, and current research on supercritical airfoils designed to achieve laminar boundary layers. In the first part the use of available two dimensional computer codes in the development of supercritical airfoils and the general trends in the design of such airfoils with turbulent boundary layers are discussed. The second part provides the necessary background on laminar boundary layer phenomena. The last part, which constitutes the major portion of the lecture, covers research by NASA on supercritical airfoils utilizing both decreasing pressure gradients and surface suction for stabilizing the laminar boundary layer. An investigation of the former has been recently conducted in flight using gloves on the wing panels of the U.S. Air Force F111 TACT airplane, research on the latter is currently being conducted in a transonic wind tunnel which has been modified to greatly reduce the stream turbulence and noise levels in the tests section. Author

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AERODYNAMIC INTERFERENCE: A GENERAL OVERVIEW

A B HAINES *In* AGARD Spec Course on Subsonic/Transonic Aerodyn Interference for Aircraft 52 p Jul 1983 refs Avail NTIS HC A13/MF A01

A general survey is given of the sources of aerodynamic interference and of how adverse interference can be avoided and favorable interference exploited in the optimisation of the design of complete configurations for modern civil transport and military combat aircraft. The basic nature of wing-body interference is discussed at some length since these effects are at the root of much of what is to follow. There is considerable emphasis on means to reduce profile, vortex and transonic wave drag but it is also stressed that favorable interference concepts can be employed to improve lift for manoeuvre and to optimise stability and control characteristics at high incidence. R J F

N84-12083# Aircraft Research Association Ltd, Bedford (England)

EXTERNAL STORES INTERFERENCE

A B HAINES *In* AGARD Spec Course on Subsonic/Transonic Aerodyn Interference for Aircraft 20 p Jul 1983 refs Avail NTIS HC A13/MF A01

External store installations are frequently a source of considerable adverse aerodynamic interference giving large increases in drag, reductions in usable lift and poor store release characteristics. This adverse interference can be greatly alleviated or even transformed into favorable interference. Some of the available evidence for a wide variety of arrangements is given. The nature of the interference, both adverse and favorable, is described, particular emphasis being placed on the major adverse interference in standard multiple carriers and in some underwing installations. The possible benefits of wing tip carriage and carefully arranged underfuselage arrays are noted. Throughout, stress is laid on the fact that dramatic improvements might be possible by adopting a radical approach to store carriage. R J F

N84-12084# Boeing Commercial Airplane Co, Seattle, Wash Aero Research and Development

INTERFERENCE PROBLEMS IN AIRCRAFT DESIGN

I H RETTIE *In* AGARD Spec Course on Subsonic/Transonic Aerodyn Interference for Aircraft 10 p Jul 1983 Avail NTIS HC A13/MF A01

The nature of aerodynamic interference among the components of an aircraft is examined. Some of the flow mechanisms involved are studied with the help of theoretical flow models with the objective of identifying design guidelines for the avoidance of performance or other penalties. The possible achievement of favorable interference in some cases is also discussed. Emphasis is placed upon the growing capability of computational methods which allow the designer to explore interference effects during the early phase of a design prior to wind tunnel tests. Author

N84-12085# Messerschmitt-Boelkow-Blohm/Entwicklungspring Nord, Bremen (West Germany)

ENGINE/AIRFRAME INTERFERENCE

G KRENZ *In* AGARD Spec Course on Subsonic/Transonic Aerodyn Interference for Aircraft 17 p Jul 1983 refs Avail NTIS HC A13/MF A01

A short review about typical aircraft representatives with different types of engine housing is given. The reasons why current commercial transport aircraft designed for the transonic flight regime prefer conventional engine locations under the wing are given. On first sight type of configuration rarely changed over the past 25 years. However, the strength of flow interference was increased considerably due to the rapid progress in engine as well as wing technology. On the engine side mainly the enlarged massflow and fan diameter contribute to the stronger interaction, while the wing tends to thicker leading to higher loaded designs with supercritical flow in the transonic flight regime. The increasing effects of wing/engine interference were studied in several transonic wind-tunnels. Results including those of varying engine distances from the transonic wing are presented. R J F

N84-12086# British Aerospace Aircraft Group, Preston (England)

ENGINE-AIRFRAME INTERFERENCE EFFECTS

A VINT *In* AGARD Spec Course on Subsonic/Transonic Aerodyn Interference for Aircraft 21 p Jul 1983 refs Avail NTIS HC A13/MF A01

The various types of interference between a turbo-jet or turbo-fan engine and the airframe as applicable to military aircraft are described in detail. Examples of the effects on overall aircraft aerodynamics are given, including, where possible, simple means for their evaluation. It is shown that the interference may give either significant benefits or penalties and that relatively minor geometric changes can have profound effects. Above all it is shown that the effects of all aspects of engine airframe interference must be known early in the design process so that pitfalls can be avoided or beneficial effects included in the initial aircraft design. R J F

N84-12087 Wichita State Univ, Kans

AN EXPERIMENTAL INVESTIGATION OF SEPARATED THREE DIMENSIONAL FLOW ON GENERAL AVIATION TWIN-ENGINE AIRCRAFT Ph.D. Thesis

C OSTOWARI 1982 131 p

Avail Univ Microfilms Order No DA8308658

Force measurements, surface flow patterns and wake total pressure surveys have been obtained for a wing, wing-body, wing-nacelle and wing-body-nacelle configuration at typical pre- and post-stall angle of attack (10 deg and 16 deg), for a general aviation twin-engine airplane. The data includes separated regions and tentative flow field models. Special total pressure survey instrumentation was designed, manufactured and utilized, to measure the extent of separated regions in a minimum amount of time. The results indicate the presence of highly three dimensional separated regions above and beyond the surface at post-stall condition. The present tests reveal that when separation occurs the viscous layers are displaced vertically, creating a much wider wake than for cases without separation. Based upon the present experimental data, combined flow field models have been proposed for each of the configurations, at the pre-stall (10 deg) and post-stall (16 deg) angle of attack condition. In all cases, the flow is shown to be forming steady three dimensional separation bubbles.

Dissert. Abstr.

N84-12088 Tennessee Univ, Knoxville

ACOUSTIC STREAMING AS A MECHANISM OF THE RANQUE-HILSCH EFFECT Ph.D. Thesis

J Q CHU 1982 99 p

Avail Univ Microfilms Order No DA8313285

The Ranque-Hilsch effect of the vortex tube effect is a striking phenomenon observed in swirling flows where air injected tangentially into a single pipe, separates spontaneously into two streams the colder stream near the tube centerline and the hotter stream near its periphery. In spite of the simplicity of the

Ranque-Hilsch tube, the mechanism of the total temperature separation, in the absence of any apparent external work, has not satisfactorily been resolved. Previously the mechanism has been purported to be due to the turbulent motion. However, if this were the mechanism, one could not explain why, in other turbulent swirling devices, the turbulence does not separate the total temperature in the same manner. Here experiments are conducted to substantiate a theory that acoustic streaming induced by the pure tone, a spinning wave present in swirling flows, deforms the base Rankine vortex into a forced vortex, resulting in total temperature separation in the radial direction. *Dissert Abstr*

N84-12089 Royal Aircraft Establishment, Farnborough (England)

RECENT ADVANCES IN PARACHUTE TECHNOLOGY

D R DENNIS 18 May 1983 28 p refs Lecture for Royal Aeron Soc, London, 10 Mar 1983

(RAE-TM-FS(F)-514, BR88700) Avail Issuing Activity

Advances in the prediction of parachute inflation loads, in formulating design rules for ram air gliding parachutes, and in parachute construction materials are summarized. Test techniques, including aircraft launched parachute test vehicles are outlined. Stability analysis and techniques for obtaining basic data are described

Author (ESA)

N84-12090*# United Technologies Corp, East Hartford, Conn
HELICOPTER ROTOR WAKE GEOMETRY AND ITS INFLUENCE IN FORWARD FLIGHT. VOLUME 1: GENERALIZED WAKE GEOMETRY AND WAKE EFFECT ON ROTOR AIRLOADS AND PERFORMANCE Final Report

T A EGOLF and A J LANDGREBE Oct 1983 222 p refs 2 Vol

(Contract NAS1-14568)

(NASA-CR-3726, NAS 1 26 3726, R83-912666-58) Avail NTIS HC A10/MF A01 CSCL 01A

An analytical investigation to generalize the wake geometry of a helicopter rotor in steady level forward flight and to demonstrate the influence of wake deformation in the prediction of rotor airloads and performance is described. A first level generalized wake model is presented which is based on theoretically predicted tip vortex geometries for a selected representative blade design. The tip vortex distortions are generalized in equation form as displacements from the classical undistorted tip vortex geometry in terms of vortex age, blade azimuth, rotor advance ratio, thrust coefficient, and number of blades. These equations were programmed in a computer module to provide distorted wake coordinates at very low cost for use in rotor airflow and airloads prediction analyses. The sensitivity of predicted rotor airloads, performance, and blade bending moments to the modeling of the tip vortex distortion are demonstrated for low to moderately high advance ratios for a representative rotor and the H-34 rotor. Comparisons with H-34 rotor test data demonstrate the effects of the classical, predicted distorted, and the newly developed generalized wake models on airloads and blade bending moments

S L.

N84-12091*# United Technologies Research Center, East Hartford, Conn

HELICOPTER ROTOR WAKE GEOMETRY AND ITS INFLUENCE IN FORWARD FLIGHT. VOLUME 2: WAKE GEOMETRY CHARTS Final Report

T A EGOLF and A J LANDGREBE Washington NASA Oct 1983 204 p 2 Vol

(Contract NAS1-14568)

(NASA-CR-3727, NAS 1 26 3727, R83-912666-58) Avail NTIS HC A10/MF A01 CSCL 01A

Isometric and projection view plots, inflow ratio nomographs, undistorted axial displacement nomographs, undistorted longitudinal and lateral coordinates, generalized axial distortion nomographs, blade/vortex passage charts, blade/vortex intersection angle nomographs, and fore and aft wake boundary charts are discussed. Example condition, in flow ratio, undistorted axial location, longitudinal and lateral coordinates, axial coordinates distortions,

blade/tip vortex intersections, angle of intersection, and fore and aft wake boundaries are also discussed.

N W

N84-12092*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va

GEOMETRIES FOR ROUGHNESS SHAPES IN LAMINAR FLOW Patent Application

B J HOLMES, G L MARTIN (Kenton Intern, Hampton, Va), C S DOMACK (Kenton Intern, Hampton, Va), C J OBARA (Kenton Intern, Hampton, Va), and A A HASSAN, inventors (to NASA) (Arizona State Univ, Tempe) 10 Nov 1983 18 p
(NASA-CASE-LAR-13255-1, US-PATENT-APPL-SN-550681)

Avail NTIS HC A02/MF A01 CSCL 01A

A passive interface mechanism between upper and lower skin structures, and a leading edge structure of a laminar flow airfoil is described. The interface mechanism takes many shapes. All are designed to be different than the sharp orthogonal arrangement prevalent in the prior art. The shapes of the interface structures are generally of two types: steps away from the centerline of the airfoil with a sloping surface directed toward the trailing edge and, the other design has a gap before the sloping surface. By properly shaping the step, the critical step height is increased by more than 50% over the orthogonal edged step

NASA

N84-12093# Air Force Geophysics Lab, Hanscom AFB, Mass Aerospace Instrumentation Div

A BALLOON DESIGN FOR 9000 POUNDS AT 90,000 FEET: RECOMMENDATIONS BASED ON HEAVY-LOAD BALLOON HISTORY Final Scientific Report

J F DWYER 9 Mar 1983 41 p

(Contract AF PROJ 7659)

(AD-A131987, AD-F000018, AFGL-TR-83-0062, AFGL-IP-315)

Avail NTIS HCA03/MFA01 CSCL 04B

The history of the development of free balloons to carry heavy payloads into the stratosphere is reviewed with the objective of developing a design based on existing technologies for a balloon to carry 9000 lb to 90,000 ft. Reinforced polyester balloons, in tandem balloon configurations, are discussed with respect to materials, design criteria, and performance. The problem of launch dynamics for single cell polyethylene balloons is also discussed and it is concluded that a capped single cell polyethylene balloon can be dynamically launched, successfully, with the 9000-lb payload. Further, it is concluded that the single cell polyethylene balloon is the best means to meet the objective. Specifications for such a balloon are provided

GRA

N84-12094# Ballistic Research Labs, Aberdeen Proving Ground, Md

A THEORETICAL AND EXPERIMENTAL INVESTIGATION OF A TRANSONIC PROJECTILE FLOW FIELD Final Report

C J NIETUBICZ, J E DANBERG, and G R INGER (West Virginia Univ) Jul 1983 32 p Supersedes IMR-712

(Contract DAAG29-78-G-0057, DA PROJ 1L1-61102-AH-43)

(AD-A131938, AD-F300295, ARBRL-MR-03291, ARBRL-IMR-712)

Avail NTIS HCA03/MFA01 CSCL 20D

The transonic flow field about a secant-ogive-cylinder-boattail with a turbulent boundary layer has been studied. A joint theoretical and experimental effort is presented which compares the results of a generalized axisymmetric Navier-Stokes code, a composite inviscid boundary-layer/shock interaction solution method, and experiment. The experimental longitudinal pressure distribution at $M = 0.94$, and 0.97 for $\alpha = 0$ degree are generally well predicted by both theoretical techniques although the Navier-Stokes solutions are shown to be superior in describing the detail, such as, upstream effects of expansion corners and the position and magnitude of minimum pressure regions. Both theoretical solutions predict the boundary layer velocity profiles very well in all cases with the largest differences occurring just downstream of the boattail corner. Comparisons of displacement thickness and skin friction distributions are also presented

GRA

02 AERODYNAMICS

N84-12095# Kentucky Univ, Lexington Dept of Mechanical Engineering
STABILITY OF A PAIR OF STATIONARY VORTICES IN THE LEEWARD SIDE OF A CYLINDER IN A POTENTIAL FLOWFIELD
Final Technical Report, May - Sep. 1981
S N SINGH Wright-Patterson AFB, Ohio AFWAL May 1983
24 p
(Contract F33615-79-C-3030, AF PROJ 2307)
(AD-A131917, AFWAL-TR-83-3067) Avail NTIS HCA02/MFA01
CSCL 20D

In this report the steady state flow of an incompressible inviscid fluid past a circular cylinder is considered when a pair of asymmetrical stationary vortices are situated in the rear of the cylinder. Complex potential for this flow is obtained with the help of Milne-Thompson's circle theorem. The condition that the vortex centers have zero induced velocity determines the positions of the stationary vortices. This condition is determined for the various combination of the free stream velocity, the radius of the cylinder, and the strengths of the vortices by the secant routine on the computer. Asymmetrical disturbances are introduced and a stability analysis of the system is performed. And finally for the stable systems, the lift force acting on the cylinder is calculated and compared with the experimental results. GRA

N84-12096*# Vought Corp, Dallas, Tex
IMPROVED WAVE DRAG PREDICTIONS USING MODIFIED LINEAR THEORY Final Technical Report, 7 Dec. 1981 - 7 Dec. 1982

R T STANCIL 7 Dec 1982 85 p Sponsored by NASA Langley Research Center
(Contract N00167-82-C-0023)
(NASA-CR-174494, NAS 1 26 174494, AD-A131634,
REPT-2-55110/2R-53299, DTNSRDC/ASED-CR-1-83) Avail NTIS HCA05/MFA01 CSCL 20D

The wave drag prediction method is based on a modified supersonic linear theory computer technique. The modified linear theory differs from ordinary linear theory in that it uses the exact, boundary condition, it uses the exact pressure coefficient equation, and it uses characteristic tracing to determine regions of influence. The theoretical and numerical techniques are described in detail. A computer user's manual is included which provides a detailed description of the inputs and outputs of the computer routine, including recommended guidelines for preparing the geometric input. Comparisons between predictions of drag or pressures using the modified linear theory are made for five cases with wind tunnel data or other theories. These comparisons verify the improved accuracy of the modified linear theory relative to ordinary linear theory, particularly for high Mach numbers and high surface slopes. GRA

N84-12097# Texas Technological Univ, Lubbock Dept of Mechanical Engineering
DYNAMIC-STALL REGULATION OF THE DARRIEUS TURBINE
J W OLER, J H STRICKLAND, B J IM, and G H. GRAHAM
Aug 1983 180 p refs
(Contract DE-AC04-76DP-00789)
(DE83-017994, SAND-83-7029) Avail NTIS HC A09/MF A01

A two dimensional unsteady airfoil analysis is described which utilizes a doublet panel method to model the airfoil surface, an integral boundary scheme to model the viscous attached flow, and discrete vortices to model the detached boundary layers which form the airfoil wake region. This model has successfully predicted steady lift and drag coefficients as well as pressure distributions for several airfoils with both attached and detached boundary layers. Unsteady calculations were limited to attached flow situations. Instantaneous pressure distributions were also obtained on a single bladed rotor operating in a tow tank in order to provide experimental data for eventual comparison with analytical predictions. DOE

N84-12098# National Aerospace Lab, Amsterdam (Netherlands)
Fluid Dynamics Div
ENGINE/AIRFRAME INTERFERENCE DRAG AT CRUISE CONDITIONS, USING PROPULSION SIMULATION
G DOORNbos and W B DEWOLF Feb 1982 31 p refs
(NLR-TR-82012-U) Avail NTIS HC A03/MF A01

A wind tunnel test procedure to determine from the thrust minus drag measurements the aircraft drag and engine/airframe interference drag at cruise conditions is described. Engine thrust simulation is provided by a calibrated turbofan powered simulator (TPS). The use of a blown nacelle as propulsion simulator is described and compared with the simulation by a TPS. It is concluded that TPS engines are valuable test tools, simulating the aircraft engine closely, but the blown nacelle can not be totally replaced by the TPS nacelle. Author (ESA)

N84-12099# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France)
AERODYNAMICS OF VORTICAL TYPE FLOWS IN THREE DIMENSIONS

Loughton, England Jul 1983 557 p refs In ENGLISH and FRENCH Symp held in Rotterdam, Netherlands, 25-28 Apr 1983
(AGARD-CP-342, ISBN-92-835-0334-1) Avail NTIS HC A24/MF A01

Separations which are frequently associated with vortical type flows are discussed. The trailing vortex system behind a lifting wing where the separation occurs at the trailing edge is noted. The use of large sweep angles with vortical flows is associated with separations forward of the trailing edge. A feature of such three dimensional flows are frequently well ordered with a defined stable structure and designers have increasingly sought to exploit them in meeting the growing speed and maneuver demands on modern aircraft. The following topics are discussed: (1) fundamentals, generation and structure of vortical flows, (2) interaction of vortical flows with surfaces, (3) modelling and computing, (4) stability and breakdown of vortical flows, (5) control and exploration of vortical flows.

N84-12100# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
ON ISSUES CONCERNING FLOW SEPARATION AND VORTICAL FLOWS IN THREE DIMENSIONS

D J PEAKE and M TOBAK In AGARD Aerodyn of Vortical Type Flows in Three Dimensions 31 p Jul 1983 refs
Avail NTIS HC A24/MF A01 CSCL 01A

Vortical flows in three dimensional configurations that are of typical interest to aerodynamicists and researchers in fluid mechanics are reviewed. A list of 10 issues was compiled to understanding complex vortical flows. E A K

N84-12101# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany)
THE VORTEX SKELETON MODEL FOR THREE-DIMENSIONAL STEADY FLOWS

H G HORNUNG In AGARD Aerodyn of Vortical Type Flows in Three Dimensions 12 p Jul 1983 refs
Avail NTIS HC A24/MF A01

The essential concepts of two dimensional separation were extended to three dimensional steady flow, and the vortex skeleton model and electromagnetic analogy are introduced. The model gives a simple topological rule by which the vortex skeleton of a flow can be established from the structure of the wall streamline pattern. The important question of the occurrence of smoothly starting separation without zeros in the wall shear stress, is examined because of a new local solution of the Navier-Stokes and continuity equations. E A K.

N84-12102# Stanford Univ, Calif Joint Inst. for Aeronautics and Acoustics

ON THE STRUCTURE OF THE TURBULENT VORTEX

L ROBERTS *In* AGARD Aerodyn of Vortical Type Flows in Three Dimensions 11 p Jul 1983 refs

Avail NTIS HC A24/MF A01

The trailing vortex generated by a lifting surface, the structure of its turbulent core and the influence of axial flow within the vortex on its initial persistence and on its subsequent decay are described. Similarity solutions of the turbulent diffusion equation are given in closed form and results are expressed in sufficiently simple terms that the influence of the lifting surface parameters on the length of persistence and the rate of decay of the vortex can be evaluated

E A K

N84-12103# Imperial Coll of Science and Technology, London (England) Dept of Aeronautics

INSTABILITIES IN TRAILING VORTICES: FLOW VISUALIZATION USING HOT-WIRE ANEMOMETRY

C STRANGE and J K HARVEY *In* AGARD Aerodyn of Vortical Type Flows in Three Dimensions 11 p Jul 1983 refs

Avail NTIS HC A24/MF A01

Trailing vortices often break up after the formation of disc shaped disturbances. A flow visualization experiment was performed in which similar strongly dissipative disturbances were produced in the laboratory. Details of the origin and development of this instability are discussed. An experiment using hot wire anemometry and a conditional sampling technique was set up. Data are presented on a solitary wave like disturbance which was found on the outer edge of the core and convected downstream at about the same velocity as the ambient fluid. It is found that the perturbation flow field associated with this disturbance is not axisymmetric

E A K

N84-12104# Office National d'Etudes et de Recherches Aerospatiales, Paris (France)

INTERACTION BETWEEN A SHOCK-WAVE AND A VORTEX FLOW

J DELERY and E HOROWITZ *In* AGARD Aerodyn. of Vortical Type Flows in Three Dimensions 19 p Jul 1983 refs In FRENCH, ENGLISH summary

Avail NTIS HC A24/MF A01

The interaction between a vortex and a shock-wave normal to the streamwise axis of the vortex was studied both experimentally and theoretically. Measurements were made for four values of the upstream Mach number ranging from 1.6 to 2.28. They allowed the characterization of the shock effect on the vortical flow structure when breakdown does not occur. They also led to the definition of a breakdown limit function of the two parameters normal shock strength - vortex swirl/ratio. Two flow configurations associated respectively with interaction without and with vortex bursting were carefully probed by using a two-color laser Doppler velocimeter system. When breakdown occurs, the mean meridian motion comprises a recirculating bubble near the axis of the structure. A flow model was developed in the framework of the Euler equations. As long as the vortex does not burst, the calculations give a faithful description of flow phenomena. They also predict a limit for vortex breakdown which agrees satisfactorily with experiment

M G

N84-12105# Cranfield Inst of Tech, Bedfordshire (England) Div of Aerodynamics

ON THE GENERATION AND SUBSEQUENT DEVELOPMENT OF SPIRAL VORTEX FLOW OVER A SWEPT-BACK WING

D I A POLL *In* AGARD Aerodyn of Vortical Type Flows in Three Dimensions 14 p Jul 1983 refs

Avail NTIS HC A24/MF A01

An experimental investigation was performed to study the formation and development of spiral vortex flow over a swept-back wing. An aerofoil section with three alternative leading edge shapes was tested at sweep angles ranging from 0 to 56 deg for unit Reynolds number of 1,000,000/m and 2,000,000/m. The principal diagnostic tool was the surface oil-flow visualization technique

supplemented by pressure distribution measurements in certain cases. No spiral vortex flow was observed for sweep angles of 0 and 15 deg but at higher sweep angles the oil-flows indicated that there were three different mechanisms for the formation of spiral vortices. The angle of incidence at the onset of vortex flow, and the mechanism responsible for its formation, were found to depend upon the sweep angle, the leading edge shape and the Reynolds number. It was also noted that the larger the leading edge radius the greater the dependence upon Reynolds number. However, comparison with other work suggests that Reynolds number, incidence and sweep angle alone are insufficient to determine the type of spiral vortex flow occurring on a given wing

M G

N84-12106# Technische Hogeschool, Delft (Netherlands) Dept. of Aerospace Engineering

AN EXPERIMENTAL INVESTIGATION OF THE VORTEX FLOW OVER DELTA AND DOUBLE-DELTA WINGS AT LOW SPEED

N. G VERHAAGEN *In* AGARD Aerodyn of Vortical Type Flows in Three Dimensions 16 p Jul 1983 refs

Avail NTIS HC A24/MF A01

A wind tunnel investigation was performed to study, by employing a laser-light-sheet and oil-flow visualization technique, the flow above and behind a sharp-edged 76 deg delta wing and two sharp-edged double-delta wing models (76/60 and 76/40 deg, kink at midchord). In addition, balance measurements were performed to determine lift, drag and pitching moment. The tests were carried out for angles of attack from 5 to 25 deg and at a free-stream velocity of 30 m/sec, corresponding to a Reynolds number of 1,400,000, based on centerline chord. Above both double-delta wings a single-branched strake vortex is formed by vorticity from the strake leading edge. Downstream of the leading-edge kink a wing vortex is formed which is conjectured to be single-branched at about 5 deg angle of attack and double branched at angles of 10 deg, and beyond. The flow pattern downstream of the trailing edge of the 76/60 deg double-delta wing was observed to be similar to that behind the delta wing. Above the 76/40 deg double-delta wing breakdown of both the wing and strake vortices took place ahead of the trailing edge

M G

N84-12107# Office National d'Etudes et de Recherches Aerospatiales, Paris (France)

VISUALIZATION OF VORTICAL TYPE FLOWS IN THREE DIMENSIONS

H WERLE *In* AGARD Aerodyn of Vortical Type Flows in Three Dimensions 20 p Jul 1983 refs In FRENCH, ENGLISH summary Previously announced as A83-44312

Avail NTIS HC A24/MF A01

Turbulence structures that have been made visible by various means are outlined. Natural occurrences such as hurricanes, whirlpools, and island wakes have been photographed by satellite, from aircraft, and from the ground. Laboratory trials with wind and water tunnels have permitted photography of flows around helicopter blades, models, airfoils at various angles of attack, and around diversely shaped and oriented objects. Smoke streamlines have been generated with titanium tetrachloride wires, kerosene, and oil vapor, or by water condensed over liquid nitrogen. Colored dyes have been released from the surface of the model and pressure distributions have been translated into lighted regions. Gases and liquids, colored or fluorescent, have served for visualizations in water channels. Spiral structures, point vortices on swept wings, bursting vortices, vortices shed from cylindrical and ellipsoidal bodies, as well as in unsteady flows have been visualized during trials in applied aerodynamics. Numerous photographic examples are provided

M S K (IAA)

02 AERODYNAMICS

N84-12108# Von Karman Inst for Fluid Dynamics, Rhode-Saint-Genese (Belgium)

LASER VELOCIMETRY STUDY OF COMPRESSIBILITY EFFECTS ON THE FLOW FIELD OF A DELTA WING

G VORROPOULOS and J F WENDT *In* AGARD Aerodyn of Vortical Type Flows in Three Dimensions 13 p Jul 1983 refs Avail NTIS HC A24/MF A01

Compressibility effects on the lee-side vortical flow field of a delta wing at incidence were studied using laser Doppler velocimetry. The tests covered the Mach number range from 0.18 to 0.80, both axial and circumferential velocity components were measured. It was found that the axial velocity excess observed at low Mach numbers became an axial velocity deficit at Mach numbers above 0.6. Strong asymmetry was observed in the circumferential velocity distribution at the higher Mach numbers. A flow picture including an embedded shock wave is proposed as physical explanation of observed compressibility effects. Author

N84-12109*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va

RECENT STUDIES AT NASA-LANGLEY OF VORTICAL FLOWS INTERACTING WITH NEIGHBORING SURFACES

J E LAMAR and J F CAMPBELL *In* AGARD Aerodyn of Vortical Type Flows in Three Dimensions 32 p Jul 1983 refs Previously announced as A83-33972

Avail NTIS HC A24/MF A01 CSCL 01A

The importance of leading edge vortical flows, which occur near and interact with neighboring surfaces, is stressed. Research in this area conducted or sponsored by the NASA Langley Research Center since 1978 is surveyed. Particular attention is given to the cumulative results of a number of theoretical and experimental studies. It is noted that these studies have been carried out in order to understand and use this kind of flow. Much of the work has been devoted to improving the lift-to-drag ratio and pitch characteristics for wings in this flow, although work has also been done on examining the unsteady and lateral characteristics.

Author

N84-12110*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va.

EXPERIMENTAL INVESTIGATION OF FOREBODY AND WING LEADING-EDGE VORTEX INTERACTIONS AT HIGH ANGLES OF ATTACK

G E ERICKSON (Northrop Corp) and W P GILBERT *In* AGARD Aerodyn of Vortical Type Flows in Three Dimensions 20 p Jul 1983 refs

(Contract NAS1-16617)

Avail NTIS HC A24/MF A01 CSCL 01A

An experimental investigation was conducted to assess the vortex flow-field interactions on an advanced, twin-jet fighter aircraft configuration at high angles of attack. Flow-field surveys were conducted on a small-scale model in the Northrop 0.41- by 0.60-meter water tunnel and, where appropriate, the qualitative observations were correlated with low-speed wind tunnel data trends obtained on a large-scale model of the advanced fighter in the NASA Langley Research Center 30- by 60-foot (9.1- by 18.3-meter) facility. Emphasis was placed on understanding the interactions of the forebody and LEX-wing vortical flows, defining the effects on rolling moment variation with sideslip, and identifying modifications to control or regulate the vortex interactions at high angles of attack. The water tunnel flow visualization results and wind tunnel data trend analysis revealed the potential for strong interactions between the forebody and LEX vortices at high angles of attack. In particular, the forebody flow development near the nose could be controlled by means of carefully-positioned radome strakes. The resultant strake-induced flow-field changes were amplified downstream by the more powerful LEX vortical motions with subsequent large effects on wing flow separation characteristics.

Author

N84-12111# Royal Aircraft Establishment, Bedford (England) Aerodynamics Dept

SOME RESULTS FROM A PROGRAMME OF RESEARCH INTO THE STRUCTURE OF VORTEX FLOW FIELDS AROUND MISSILE SHAPES

T R BYRAM, A PETERSEN (British Aerospace PLC), and S T KITSON *In* AGARD Aerodyn of Vortical Type Flows in Three Dimensions 20 p Jul 1983 refs

Avail NTIS HC A24/MF A01

Wind tunnel tests were performed to measure the leeside flow field of a generalized missile model at an angle of attack of 14 degrees and freestream Mach numbers of 0.7 and 1.8. Flow field data are presented for a station towards the rear of the model showing the flow structure for the body alone and the effects of mounting a cruciform set of delta fins near to the nose and near to the base. The data presented include vector plots of the components of velocity in the cross flow plane, the distributions of local total pressure, local Mach number and vorticity. The presence of the set of forward mounted fins and its roll orientation was found to have a significant effect on the development of the body vortices. Fins mounted towards the rear of the body were found to disrupt the body vortex feeding region but had little effect on the vortex centers unless these lay in or very close to the plane of the fins.

R J F

N84-12112*# Analytical Methods, Inc, Bellevue, Wash

PREDICTING AERODYNAMIC CHARACTERISTICS OF VORTICAL FLOWS ON THREE-DIMENSIONAL CONFIGURATIONS USING A SURFACE-SINGULARITY PANEL METHOD

B MASKEW *In* AGARD Aerodyn of Vortical Type Flows in Three Dimensions 12 p Jul 1983 refs

(Contract NAS2-8788, N00014-78-C-0128, N00014-82-C-0354, DAAG29-81-C-0032)

Avail NTIS HC A24/MF A01

A general low-order surface-singularity panel method is used to predict the aerodynamic characteristics of a problem where a wing-tip vortex from one wing closely interacts with an aft mounted wing in a low Reynolds Number flow, i.e., 125,000. Nonlinear effects due to wake roll-up and the influence of the wings on the vortex path are included in the calculation by using a coupled iterative wake relaxation scheme. The interaction also affects the wing pressures and boundary layer characteristics; these effects are also considered using coupled integral boundary layer codes and preliminary calculations using free vortex sheet separation modelling are included. Calculated results are compared with water tunnel experimental data with generally remarkably good agreement.

Author

N84-12113# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany) Inst for Experimental Fluid Mechanics

SEPARATION AND VORTICAL-TYPE FLOW AROUND A PROLATE SPHEROID: EVALUATION OF RELEVANT PARAMETERS

H VOLLMERS, H P KREPLIN, and H U MEIER *In* AGARD Aerodyn of Vortical Type Flows in Three Dimensions 14 p Jul 1983 refs

Avail NTIS HC A24/MF A01

The definition of some special lines in a flow field is discussed and a criterion for the identification of axes of local rotation is given. A preferred direction is introduced in space using the local direction of the velocity. A surface is constructed locally such that at any point the surface is normal to the velocity field. For a (normalized) direction field of the velocity, the components of the gradient tensor on this surface can be regarded as being equivalent to the curvature tensor of the surface. The behavior of the curvature is discussed. The surface is partitioned into hyperbolic and elliptic regions by the sign of the Gaussian curvature. It is found that the special points are associated with regions of extremely steep variations of the Gaussian curvature. Experimental evidence to this effect is provided by measurements of wall shear stress vectors and velocity vectors in the flow field around an inclined prolate

spheroid The above procedure is shown to be a tool for revealing some properties of the vortex skeleton of a flow field Several other parameters of the measured flow field are also evaluated and presented Author

N84-12114# Ministry of National Defence, Athens (Greece)
Defence Industry Directorate
ON THE GENERATION OF VORTICAL FLOW AT HYPERSONIC SPEEDS OVER ELLIPTICAL CONES
P EVANGELOU *In* AGARD Aerodyn of Vortical Type Flows in Three Dimensions 9 p Jul 1983 refs

Avail NTIS HC A24/MF A01

A method for calculating the hypersonic slip flow around slender elliptic cones at slight angle of attack is developed. The governing equations are derived from the Navier-Stokes equations and the energy equation by an order of magnitude analysis. There results a system of partial nonlinear parabolic differential equations for the flow variables of the shock formation regime. The system is integrated by means of an explicit finite-difference scheme and the results so obtained are compared with experimental data. Finally the influence of the elliptic cross section geometry as well as the influence of the angle of attack on the flow field properties with particular attention on the cross flow are investigated Author

N84-12115# National Aeronautical Establishment, Ottawa (Ontario) Low Speed Aerodynamic Lab
VISCOUS THREE-DIMENSIONAL FLOW SEPARATIONS FROM HIGH-WING PROPELLER-TURBINE NACELLE MODELS
R H WICKENS *In* AGARD Aerodyn of Vortical Type Flows in Three Dimensions 29 p Jul 1983 refs

Avail NTIS HC A24/MF A01

This paper describes an investigation of viscous three dimensional flows on high-wing nacelle configurations which are typical of current commuter aircraft. Flow visualization on two nacelle configurations was used to depict the viscous vortex separations in the underwing junction, the nacelle afterbody, and the wing upper surface over the central region. The surface shear stress patterns, although complex, were composed of combinations of elementary three dimensional viscous flows and free vortices which stream downwind. A strong vortex flow was produced over the top of the wing by the use of leading edge extensions along the forward portion of the nacelle. Observations were also made of the effects of a propeller slip-stream and the distortion of this propulsive flow by the mutual interference of the wing and nacelle Author

N84-12116# Royal Aircraft Establishment, Farnborough (England) Aerodynamics Dept
THEORETICAL MODELLING OF THREE-DIMENSIONAL VORTEX FLOWS IN AERODYNAMICS
J. H B SMITH *In* AGARD Aerodyn of Vortical Type Flows in Three Dimensions 21 p Jul 1983 refs

Avail NTIS HC A24/MF A01

A unified account is presented of the various inviscid models used to represent three dimensional vortex flows in aerodynamics, essentially those relying on vortex sheets and line-vortices. Recent developments in extending the scope, accuracy, and stability of these models are described. An evaluation of their relative strengths and weaknesses suggests that the different models all have continuing roles to play. It is claimed that vortex modelling has come of age, in the sense that we can now learn about the real world from the behavior of models, after decades of trying to make the models conform with reality Author

N84-12117# National Aerospace Lab, Amsterdam (Netherlands) Fluid Dynamics Div
COMPUTATIONAL VORTEX FLOW AERODYNAMICS
H W M HOEIJMAKERS *In* AGARD Aerodyn of Vortical Type Flows in Three Dimensions 35 p Jul 1983 refs Sponsored in part by Royal Netherlands Air Force

Avail NTIS HC A24/MF A01

A review is presented of computational methods for the determination of the characteristics of vortical type flows occurring

in aircraft aerodynamics. The review covers primarily computational methods for computing the downstream development of vortex wakes and methods for computing the characteristics of configurations with leading-edge and strake vortices. The various computational methods in use at present are discussed in some detail. The possibilities and limitations of the methods are indicated and results of different methods are compared and discussed Author

N84-12118# Messerschmitt-Boelkow-Blohm G m b H, Ottobrunn (West Germany)

VORTEX FLOW SIMULATIONS PAST WINGS USING THE EULER-EQUATIONS

C WEILAND *In* AGARD Aerodyn of Vortical Type Flows in Three Dimensions 12 p Jul 1983 refs

Avail NTIS HC A24/MF A01

Flow fields with vortex separation play an important role in the aerodynamics of missiles and for airplanes. Investigations carried out recently have shown that such flow fields can be computed by means of solutions of the Euler-equations. In the present paper results are presented for flow fields around delta-wings with freestream Mach number larger than 1. The range of the angle of attack is up to alpha = 15 deg. The Euler-equations are integrated by using a space-marching finite-difference method. The delta-wings have got sharp and blunted leading edges. At the sharp leading edge a condition is prescribed which produces a tangential discontinuity by means of which vorticity is introduced into the flow field. The formulation of the governing equations, the boundary conditions and the initial data is discussed. The results shown are the contours of the bow shock, the isobars, the lines of constant total pressure and the velocity vectors of the cross flow. The wave drag is determined by evaluating the integral for the momentum in an adequate surface in the flow field Author

N84-12119# Office National d'Etudes et de Recherches Aerospatiales, Paris (France)

SIMULATION OF TURBULENT FLOWS WITH A POINT VORTEX METHOD

S HUBERSON *In* AGARD Aerodyn of Vortical Type Flows in Three Dimensions 8 p Jul 1983 refs Previously announced as A83-44313

Avail NTIS HC A24/MF A01

Turbulent flows are modelled by the method defined by Rehbach (1977) for treating three dimensional, incompressible flows of a perfect fluid. The Helmholtz equation is used to calculate the temporal evolution of the vortices, the rotational velocity field, and the continuity equation. The velocity field is then obtained as a function of the Biot-Savart integral and the vortex field is discretized in terms of vortex particles, with the flow described by two fields of discrete vectors vortices and temporal position. The formulation allows the use of a very fine mesh, with the number of grid points chosen limited by the amount of computing power and time available. A technique is defined for determining the magnitude of the error associated with the total number of grid points used. Examples are provided for turbulence in two dimensional flows. The technique is demonstrated to represent well deformation and elongation of the vortex eddies M S K (IAA)

N84-12120# Aeronautical Research Inst of Sweden, Bromma
NUMERICAL SOLUTIONS OF THE EULER EQUATIONS SIMULATING VORTEX FLOWS AROUND WINGS

A RIZZI, L E ERIKSSON, W SCHMIDT, and S HITZEL *In* AGARD Aerodyn of Vortical Type Flows in Three Dimensions 14 p Jul 1983 refs Prepared in cooperation with Dornier G m b H, Friedrichshafen, West Germany

Avail NTIS HC A24/MF A01

The Euler equations was established as an appropriate model for inviscid vortex flow. The range of this model's applicability is demonstrated by presentation of flowfields computed around a number of different wings with either sharp or rounded edges and at subsonic, transonic, and supersonic speeds. The emphasis here is on the physics of the flow model rather than the numerical

02 AERODYNAMICS

aspects of the solution method. The results display both expected as well as unexpected vortex phenomena and indicate the value of this computational tool. Particular attention is paid to the wake regions

Author

N84-12121*# Tennessee Univ Space Inst, Tullahoma THE TREATMENT OF CONVECTED VORTICES IN COMPRESSIBLE POTENTIAL FLOW

J STEINHOFF, K RAMACHANDRAN, and K SURYANARAYANAN *In* AGARD Aerodyn of Vortical Type Flows in Three Dimensions 12 p Jul 1983 refs Sponsored in part by NASA-Ames

Avail NTIS HC A24/MF A01

A method is described for incorporating line vortices into the three dimensional compressible potential flow equation. A modified Biot-Savart law is used to compute a vortical velocity field, which is added to the gradient of the potential to form a total velocity. A rapidly converging approximate factorization (AFZ) scheme is then used to compute a potential such that the modified potential flow equation as well as the appropriate boundary conditions, based on total velocity, are satisfied. As part of a coupled iteration procedure, the positions of the line vortices are computed so that they convect with the total flow. The method is used to compute the field due to a single line vortex convecting past a wing. This represents an approximation of the effect of a canard or other lifting surface ahead of the wing, which sheds a tip vortex. It is seen that the flow field is substantially modified by the passage of the vortex. Unlike Euler equation schemes, which are also used to compute these flows, the solutions exhibit no numerical diffusion. The convected vortices retain their initial upstream width. Euler solutions, on the other hand, involve a vorticity which is numerically convected in an Eulerian frame and, unless extensive adaptive grid refinement is used, they result in vortices with spread as they convect. Also, the potential flow method requires approximately two orders of magnitude less computing time and much less computer storage than the Euler methods

Author

N84-12122# Cornell Univ, Ithaca, NY School of Mechanical and Aerospace Engineering

VORTEX STABILITY AND BREAKDOWN

S LEIBOVICH *In* AGARD Aerodyn of Vortical Type Flows in Three Dimensions 22 p Jul 1983 refs

(Contract NSF CME-79-19817)

Avail NTIS HC A24/MF A01

Theoretical and experimental results, some quite recent, on the instability and breakdown of concentrated vortices at high Reynolds numbers are reviewed. Wave related theories of the vortex breakdown phenomenon are treated in some detail, these appear to provide a qualitative description of the response of vortex breakdown to variations in swirl or flow rate, and Benjamin's criticality classification, a wave-based concept, is consistent with experiment data. Known general criteria for the stability or instability of inviscid columnar vortices are reviewed, together with numerical studies of an inviscid vortex model that provides an excellent analytical fit to measured velocity profiles in vortices that experience breakdown. A new analysis of experimental data on vortex breakdown flows sheds light on the interplay between criticality and instability. The flows sufficiently far upstream of breakdowns to be unaffected by them are supercritical and stable, but they are generally closer to marginal instability than they are to criticality. The wakes are both subcritical and unstable. A conceptual framework for vortex breakdown, incorporating nonlinear wave theory and instability to three dimensional disturbances, is suggested based on information derived from the experimental studies

Author

N84-12123# Trondheim Univ (Norway) Inst for Mekanikk THE BREAK-UP MECHANISM OF A STREAMWISE DIRECTED VORTEX

L N PERSEN *In* AGARD Aerodyn of Vortical Type Flows in Three Dimensions 5 p Jul 1983 refs
Avail NTIS HC A24/MF A01

The possible break-up mechanism of a vortex with its axis parallel to the direction of the mean flow is considered. Such streamwise directed vortices were considered first of all by G I Taylor in his investigation of the stability of the flow between two concentric cylinders. H Gortler has made studies of streamwise directed vortices along a concave wall. In both these cases the vortices created seem to be very stable in the side-wise direction. However the G I Taylor vortices do not change in the direction of the mean flow, and thus do not exhibit any breakup mechanisms. In very many cases encountered under different flow conditions the breakup of a stream-wise directed vortex occurs after a certain distance downstream, and a possible mechanism whereby such a break-up can occur is presented. This mechanism is inherent in the basic equations of the flow, and as such is also exhibited on the equations of motion a non-viscous fluid

Author

N84-12124# Brown Boveri Research Center, Baden (Switzerland)

VORTEX BREAKDOWN: A TWO-STAGE TRANSITION

M P ESCUDIER and J J KELLER *In* AGARD Aerodyn. of Vortical Type Flows in Three Dimensions 8 p Jul 1983 refs
Avail NTIS HC A24/MF A01

It is demonstrated that a large-scale isentropic transition between conjugate swirling flow states can occur with no change in the flow force and that both flow states are supercritical. It is argued that such a transition represents the first stage of vortex breakdown in a tube, the second stage being a non-isentropic transition in the nature of a hydraulic jump to the downstream subcritical state. The intermediate (supercritical) state consists of a zone of stagnant fluid surrounded by a region of potential flow. These two zones are separated by a layer of rotational fluid originating in the upstream flow modelled as a Rankine vortex. It is found that for any ratio of core-to-tube radii, breakdown (i.e. the first transition) occurs for a unique value of the swirl number. In the limiting case of an infinitesimally small core, the value is the square root of 2 compared with the critical value 2.405. It is argued that this limit cannot represent free breakdown, which in consequence must have a different character from the tube-flow breakdowns generally observed

Author

N84-12125# Technische Hochschule, Aachen (West Germany) Aerodynamisches Inst

A CONTRIBUTION TO THE PROBLEM OF VORTEX BREAKDOWN

E KRAUSE *In* AGARD Aerodyn of Vortical Type Flows in Three Dimensions 4 p Jul 1983 refs
Avail NTIS HC A24/MF A01

Associated with the breakdown process is the formation of a stagnation point on the axis of the vortex. This requires the deceleration of the axial velocity component, which must be enforced by a positive axial pressure gradient. An analysis is presented which shows how the pressure gradient along the axis of the vortex is influenced by the radial and azimuthal velocity components. An explicit expression for $\Delta p/\Delta x(x,0)$ can be obtained by integration of the momentum equation for the radial velocity component with respect to the radial and subsequent differentiation of the integral with respect to the axial direction. In an order of magnitude analysis, it is then demonstrated that for large Reynolds numbers one component of the frictional force in the azimuthal direction cannot be neglected. In order to obtain an estimate for the pressure gradient rigid body rotation is assumed for the vortex core, and a distribution similar to that of a potential vortex, for the outer portion. The estimate shows that a positive axial pressure gradient can exist only, if the radial velocity component is positive and if the exponent is less than unity. It is also verified that a potential vortex cannot support an axial pressure gradient, that the pressure gradient in magnitude is directly

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secondary separation line, as a function of the angle of attack. A slotted delta wing model was then built and tests were carried on, showing a remarkable shift of the location of the secondary separation line. In addition, the secondary vortex flow was investigated by means of a tracing gas technique, based on the injection of Helium on the upper surface of the wing and measurements of its concentration in the flow downstream. Boundary layer segmentation appears to be a useful tool in preventing large secondary separations and allows higher lift coefficients to be obtained. It is reasonable to suppose that results similar to those reached for this delta wing could be expected also for conventional highly swept wings. Author

N84-12133* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif

AUGMENTATION OF FIGHTER-AIRCRAFT PERFORMANCE BY SPANWISE BLOWING OVER THE WING LEADING EDGE

A SEGINER (Technion-Israel Inst. of Technology) and M SALOMON (SAL Engineering) *In AGARD Aerodyn of Vortical Type Flows in Three Dimensions* 26 p Jul 1983 refs

Avail NTIS HC A24/MF A01 CSCL 01A

Spanwise blowing over the wing and canard of a 1.35 model of a close-coupled-canard fighter-airplane configuration (similar to the Kfir-C2) was investigated experimentally in low-speed flow. Tests were conducted at airspeeds of 30 m/sec (Reynolds number of 1.8×10^6 to the 5th power based on mean aerodynamic chord) with angle-of-attack sweeps from -8 deg to 60 deg, and yaw-angle sweeps from -8 deg to 36 deg at fixed angles of attack 0 deg, 10 deg, 20 deg, 25 deg, 30 deg, and 35 deg. Significant improvement in lift-curve slope, maximum lift, drag polar and lateral/directional stability was found, enlarging the flight envelope beyond its previous low-speed/maximum-lift limit. In spite of the highly swept (60 deg) leading edge, the efficiency of the lift augmentation by blowing was relatively high and was found to increase with increasing blowing momentum on the close-coupled-canard configuration. Interesting possibilities of obtaining much higher efficiencies with swirling jets were indicated. Author

N84-12134 Wichita State Univ, Kans

A STUDY OF WING-BODY AERODYNAMIC INTERFERENCE OF A LIGHT TWIN AIRCRAFT UTILIZING A PANEL METHOD POTENTIAL FLOW PROGRAM Ph.D. Thesis

W G THOMSON 1982 112 p

Avail Univ Microfilms Order No DA8308657

An analytical and experimental study of wing-body aerodynamic interference has been conducted for a general aviation light twin aircraft. The analysis method used a panel methods potential flow computer program. Although the inviscid method used did not yield quantitative changes in drag, it was found to be useful in designing shapes for reducing pressure gradients, thus reducing the tendency for boundary layer growth and separation. Both the influence of the wing on the body and the influence of the body on the wing are considered. While information from this analysis can be used to reduce the number of experimental parametric studies, it does not eliminate the need for experiments for tuning and verification. Dissert. Abstr

N84-12135 Georgia Inst of Tech, Atlanta

STUDY OF AN ASYMPTOTIC METHOD FOR HELICOPTER ROTOR BLADE AERODYNAMIC LOADS Ph.D. Thesis

V R ANAND 1982 193 p

Avail Univ Microfilms Order No DA8310651

A study has been conducted of Van Holten's approach to airload calculation for a helicopter rotor blade in forward flight. The airloads are systematically determined using a matched asymptotic expansion technique in an acceleration potential formulation. For a straight wing in steady flow, the method is equivalent to either simple or extended lifting line theory, depending on the order of the solution. Results for a pitching wing compare well with Reissner's analysis. Under the assumptions of incompressible flow and small disturbances, Van Holten's approach is found to be basically valid for a rotor in forward flight. Measured airloads for a two-bladed teetering model rotor and a four-bladed

articulated full-scale rotor are compared with computations using Van Holten's method, Willmer's method, an actuator disk method and a discrete vortex wake method. Better agreement is obtained for the two-bladed rotor, possibly due to greater rotor/wake interaction for the four-bladed rotor. Of the computations, the asymptotic method and the discrete vortex wake method are generally found to yield the best results

Dissert Abstr

N84-12136 Stanford Univ, Calif

STEADY AND UNSTEADY FLOW MODELS FOR AIRFOILS WITH SPOILER Ph.D. Thesis

A OMARAMRANI 1983 154 p

Avail Univ Microfilms Order No DA8307195

The study of the complex problem of spoiler aerodynamics can be divided into three main categories (1) mean flow characteristics, (2) spoiler actuation, (3) wake vortex shedding. The first part of this work was consequently concerned with the steady state flow around the airfoil/spoiler system. A separated flow model for a multi-component airfoil with spoiler has been developed. The method uses a surface vorticity analysis to compute the potential flow in conjunction with an integral boundary layer method to predict separation. An iterative approach has been selected for the estimate of the wake geometry. The second part was concerned with the unsteady flow due to a fast spoiler deflection. A non-linear inviscid flow model was formulated. The method utilizes a distributed-singularities analysis for the computation of the flow. The wake formation and spoiler motion effects can be modelled separately which allows for a geometric approximation of the wake region

Dissert Abstr

N84-13145* Office National d'Etudes et de Recherches Aerospatiales, Paris (France)

ANALYSIS OF PRESSURE DISTRIBUTIONS ON A WING WITH AN OSCILLATING TRAILING EDGE FLAP IN SUBSONIC AND TRANSONIC FLOW

H CONSIGNY *In its* La Rech Aerospatiale, Bimonthly Bull No 1982-2, 207/Mar-April 1982 (ESA-TT-759) p 15-33 Sep 1982 refs Transl into ENGLISH from La Rech Aerospatiale, Bull Bimestriel (Paris) No 1982-2, 207/Mar-Apr 1982

Avail NTIS HC A05/MF A01

The three dimensional unsteady effects of an oscillating part-span trailing-edge flap were studied. The experiments were performed on a constant chord (0.3 m) and constant thickness (16%) supercritical wing mounted on the side-wall of the 1.76 x 1.75 m S2 transonic wind tunnel. The model was fitted with some 238 static pressure taps and 136 small unsteady pressure transducers (Kulite) located at several spanwise stations. Extensive information on the influence of various parameters on both steady and unsteady chordwise pressure distributions and aerodynamic coefficients (normal force, pitching moment, hinge moment) were provided. The experimental oscillatory pressures and aerodynamic coefficients were also compared with those obtained by calculations based on the solution of the classical unsteady transonic small disturbances (TSD) form of the three dimensional potential equation. The extent to which this method is capable of reproducing the influence of the various parameters experimentally observed was examined. The experimental data obtained over a wide range of parameters turned out to be particularly useful in determining the practical limits of such a theoretical approach

Author

N84-13148 Washington Univ, Seattle

INVESTIGATION OF AXISYMMETRIC CONFINED TURBULENT JET MIXING IN THE NEAR REGION WITH ADVERSE PRESSURE GRADIENT Ph.D. Thesis

D W CHOI 1983 328 p

Avail Univ Microfilms Order No DA8312129

The mixing of a subsonic confined coaxial jet with a secondary air stream is described both analytically and experimentally. Emphasis is placed on the potential core region, turbulent boundary layer - mixing layer interaction, and the effect of adverse pressure gradient on the mixing. In the experimental approach, the flow is investigated from the inlet where the jet and secondary velocities are uniform to a location downstream where the flow energies to

a transition region In the analytical approach, an appropriate turbulence model is developed, the matching condition of a boundary layer and a mixing layer is considered, and sets of numerical solutions obtained by using an implicit finite difference technique are described It was found that the radial turbulent normal stress is much higher by 1.2 times than the longitudinal one in the initial mixing region and the detailed information regarding to pressure distributions and streamline distributions in the wake region and in the early mixing region is deduced Dissert Abstr

N84-13149* # Georgia Inst of Tech, Atlanta
A VISCOUS-INVISCID INTERACTIVE PROCEDURE FOR ROTATIONAL FLOW IN CASCADES OF TWO DIMENSIONAL AIRFOILS OF ARBITRARY SHAPE Final Report, 15 Mar. 1979 - 13 Aug. 1982
 W A JOHNSTON 1983 65 p refs
 (Contract NSG-3260)
 (NASA-CR-174609, NAS 1 26 174609) Avail NTIS HC A04/MF A01

A viscous-inviscid interactive calculation procedure is developed for application to flow in cascades of two-dimensional airfoils This procedure has essentially three components First, a numerical solution of the Eules equations which can accomodate an arbitrarily specified cascade geometry is carried out on a nonorthogonal curvilinear grid mesh that is fitted to the geometry of the cascade A method of grid generation has been used which relies in part on a succession of conformal mappings Second, a viscous solution for use in boundary layers and wake regions was programmed Finally, an interactive scheme which takes the form of a source-sink distribution along the blade surface and wake centerline is employed Results were obtained with this procedure for several cascade flow situations, and some comparisons with experiment are presented

Author

N84-13150* # National Aeronautics and Space Administration Langley Research Center, Hampton, Va
XTRAN2L: A PROGRAM FOR SOLVING THE GENERAL-FREQUENCY UNSTEADY TRANSONIC SMALL DISTURBANCE EQUATION
 W WHITLOW, JR Nov 1983 29 p refs
 (NASA-TM-85723, NAS 1 15 85723) Avail NTIS HC A03/MF A01 CSCL 01A

A program, XTRAN2L, for solving the general-frequency unsteady transonic small disturbance potential equation was developed It is a modification of the LTRAN2-NLR code The alternating-direction-implicit (ADI) method of Rizzetta and Chin is used to advance solutions of the potential equation in time Engquist-Osher monotone spatial differencing is used in the ADI solution algorithm As a result, the XTRAN2L code is more robust and more efficient than similar codes that use Murman-Cole type-dependent spatial differencing Nonreflecting boundary conditions that are consistent with the general-frequency equation have been developed and implemented at the far-field boundaries Use of those conditions allow the computational boundaries to be moved closer to the airfoil with no loss of accuracy This makes the XTRAN2L code more economical to use

Author

N84-13151* # National Aeronautics and Space Administration Langley Research Center, Hampton, Va
TABULATION OF DATA FROM TESTS OF AN NPL 9510 AIRFOIL IN THE LANGLEY 0.3-METER TRANSONIC CRYOGENIC TUNNEL

R V JENKINS Nov 1983 237 p refs
 (NASA-TM-84579, NAS 1 15 84579) Avail NTIS HC A11/MF A01 CSCL 01A

The tabulated data from tests of a six inch chord NPL 9510 airfoil in the Langley 0 3-Meter Transonic Cryogenic Tunnel The tests were performed over the following range of conditions. Mach numbers of 0 35 to 0 82, total temperature of 94 K to 300 K, total pressure of 1 20 to 5 81 atm, Reynolds number based on chord of 1.34×10^6 to the 6th to 48.23×10^6 to the 6th, and angle of attack of 0 deg to 6 deg The NPL 9510 airfoil was observed to

have decreasing drag coefficient up to the highest test Reynolds number

Author

N84-13152* # National Aeronautics and Space Administration Langley Research Center, Hampton, Va
INVESTIGATION OF INSTALLATION EFFECTS ON TWIN-ENGINE CONVERGENT-DIVERGENT NOZZLES
 E A BARE and B L. BERRIER Nov 1983 191 p refs
 (NASA-TP-2205, L-15609, NAS 1 60 2205) Avail NTIS HC A09/MF A01 CSCL 01A

An investigation was conducted in the Langley 16-Foot Transonic Tunnel to determine installation effects on convergent-divergent nozzles applicable to twin-engine reduced-power supersonic cruise aircraft Tests were conducted at Mach numbers from 0 50 to 1 20, angles of attack from -5 deg to 9 deg, and at nozzle pressure ratios from jet off (1 0) to 8 0 The effects of empennage arrangement, nozzle length, and afterbody closure on total and component drag coefficients were investigated

Author

N84-13153* # Boeing Commercial Airplane Co, Seattle, Wash
SPECIFICATION FOR A PROGRAM FOR AN ITERATIVE AEROELASTIC SOLUTION (PIAS)
 M E MANRO, M J DONAHUE, R L DREISBACH, and J E BUSSOLETTI Dec 1983 99 p refs
 (Contract NAS1-16740)
 (NASA-CR-172200, NAS 1 26 172200, D6-52134) Avail NTIS HC A05/MF A01 CSCL 01A

An engineering and software specification which was written for a computer program to calculate aeroelastic structural loads including the effects of nonlinear aerodynamics is presented The procedure used in the program for an iterative aeroelastic solution (PIAS) is to alternately execute two computer codes one to calculate aerodynamic loads for a specific wing shape, and another to calculate the deflected shape caused by this loading A significant advantage to the design of PIAS is that the initial aerodynamic module can be replaced with others The leading edge vortex (LEV) program is used as the aerodynamic module in PIAS This provides the capability to calculate aeroelastic loads, including the effects of a separation induced leading edge vortex The finite element method available in ATLAS Integrated structural analysis and design system is used to determine the deflected wing shape for the applied aerodynamics and inertia loads The data management capabilities in ATLAS are used by the execution control monitor (ECM) of PIAS to control the solution process

E A K

N84-13154* # National Aerospace Lab, Tokyo (Japan)
AN APPROXIMATE METHOD OF ESTIMATING THE AERODYNAMIC INTERFERENCE BETWEEN TWO PARALLEL BODIES (NORMAL FORCE AND SIDE FORCE)
 H KONDO 1983 17 p refs In JAPANESE, ENGLISH summary
 (NAL-TR-752, ISSN-0389-4010) Avail NTIS HC A02/MF A01

The present study deals with an approximate method of estimating the aerodynamic interference between two parallel bodies Formulae are derived from the slender body theory The formulae for calculating the normal force and side force on one body are obtained as functions of the bank angle and the relative distances between bodies The results of the calculation are compared with those from wind tunnel tests and fairly good agreement is obtained in some restricted region It is pointed out that the present method can easily be extended to a combination of more than two bodies

02 AERODYNAMICS

N84-13155# Aeronautical Research Inst of Sweden, Stockholm

Aerodynamics Dept

DEVELOPMENT OF A COMPUTER CODE FOR A THREE-DIMENSIONAL HIGHER ORDER PANEL METHOD FOR SUBSONIC POTENTIAL FLOW

L E ERIKSSON 8 Jul 1983 73 p refs

(FFA-138) Avail NTIS HC A04/MF A01

A computer code for the computation of subsonic inviscid flow around wings and wing-body configurations was developed using the boundary integral method or panel method. The method is based on the idea of independent surface networks with piecewise linear source distributions and piecewise quadratic dipole distributions. The effect of surface curvature is included to make the overall approximation consistent. Several numerical tests and comparisons indicate that the method gives accurate and reliable results and that these results are insensitive to the surface discretization.

Author

N84-13156# National Inst for Aeronautics and Systems Technology, Pretoria (South Africa)

AN ANALYTICAL METHOD TO CALCULATE THE FLOW FIELD ABOUT BLUNT BODIES OF REVOLUTION AT INCIDENCE IN SUPERSONIC FREE STREAM FLOW

G J VANDENBROEK Oct 1982 130 p refs

(CSIR-NIAST-82/72) Avail NTIS HC A07/MF A01

An analytical method to calculate the shock shape, stand-off distance and flow field generated by a blunt body of revolution at incidence in supersonic free stream flow, is described. A time-dependent finite-difference technique is used, in which the shock wave is treated as a moving discontinuity. The steady state pattern is established asymptotically.

Author

N84-13157# Stanford Univ , Calif

ANALYTICAL MODEL OF ROTOR WAKE AERODYNAMICS IN GROUND EFFECT

H A SABERI Dec 1983 96 p refs

(Contract NSG-2400)

(NASA-CR-166533, NAS 1 26 166533) Avail NTIS HC A05/MF A01 CSCL 01A

The model and the computer program developed provides the velocity, location, and circulation of the tip vortices of a two-blade helicopter in and out of the ground effect. Comparison of the theoretical results with some experimental measurements for the location of the wake indicate that there is excellent accuracy in the vicinity of the rotor and fair amount of accuracy far from it. Having the location of the wake at all times enables us to compute the history of the velocity and the location of any point in the flow. The main goal of our study, induced velocity at the rotor, can also be calculated in addition to stream lines and streak lines. Since the wake location close to the rotor is known more accurately than at other places, the calculated induced velocity over the disc should be a good estimate of the real induced velocity, with the exception of the blade location, because each blade was replaced only by a vortex line. Because no experimental measurements of the wake close to the ground were available to us, quantitative evaluation of the theoretical wake was not possible. But qualitatively we have been able to show excellent agreement. Comparison of flow visualization with our results has indicated the location of the ground vortex is estimated excellently. Also the flow field in hover is well represented.

Author

N84-13158# Lockheed-Georgia Co , Marietta

A GRID-EMBEDDING TRANSONIC FLOW ANALYSIS COMPUTER PROGRAM FOR WING/NACELLE CONFIGURATIONS Final Report

E H ATTA and J VADYAK Nov 1983 109 p refs

(Contract NAS2-11285)

(NASA-CR-166529, NAS 1 26 166529, LG83ER0164) Avail

NTIS HC A06/MF A01 CSCL 01A

An efficient grid-interfacing zonal algorithm was developed for computing the three-dimensional transonic flow field about wing/nacelle configurations. The algorithm uses the full-potential formulation and the AF2 approximate factorization scheme. The

flow field solution is computed using a component-adaptive grid approach in which separate grids are employed for the individual components in the multi-component configuration, where each component grid is optimized for a particular geometry such as the wing or nacelle. The wing and nacelle component grids are allowed to overlap, and flow field information is transmitted from one grid to another through the overlap region using trivariate interpolation. This report represents a discussion of the computational methods used to generate both the wing and nacelle component grids, the technique used to interface the component grids, and the method used to obtain the inviscid flow solution. Computed results and correlations with experiment are presented. Also presented are discussions on the organization of the wing grid generation (GRGEN3) and nacelle grid generation (NGRIDA) computer programs, the grid interface (LK) computer program, and the wing/nacelle flow solution (TWN) computer program. Descriptions of the respective subroutines, definitions of the required input parameters, a discussion on interpretation of the output, and the sample cases illustrating application of the analysis are provided for each of the four computer programs.

Author

N84-13159# Lockheed-Georgia Co , Marietta

A COMPUTER PROGRAM FOR THE CALCULATION OF THREE-DIMENSIONAL TRANSONIC NACELLE/INLET FLOWFIELDS Final Report

J VADYAK and E H ATTA Moffett Field, Calif NASA Ames Research Center Nov. 1983 102 p refs

(Contract NAS2-11285)

(NASA-CR-166528, NAS 1 26 166528, LG83ER0163) Avail

NTIS HC A06/MF A01 CSCL 01A

A highly efficient computer analysis was developed for predicting transonic nacelle/inlet flowfields. This algorithm can compute the three-dimensional transonic flowfield about axisymmetric (or asymmetric) nacelle/inlet configurations at zero or nonzero incidence. The flowfield is determined by solving the full-potential equation in conservative form on a body-fitted curvilinear computational mesh. The difference equations are solved using the AF2 approximate factorization scheme. This report presents a discussion of the computational methods used to both generate the body-fitted curvilinear mesh and to obtain the inviscid flow solution. Computed results and correlations with existing methods and experiment are presented. Also presented are discussions on the organization of the grid generation (NGRIDA) computer program and the flow solution (NACELLE) computer program, descriptions of the respective subroutines, definitions of the required input parameters for both algorithms, a brief discussion on interpretation of the output, and sample cases to illustrate application of the analysis.

Author

N84-13160# National Aeronautics and Space Administration Langley Research Center, Hampton, Va

VORTEX FLAP FLOW REATTACHMENT LINE AND SUBSONIC LONGITUDINAL AERODYNAMIC DATA ON 50 DEG TO 74 DEG DELTA WINGS ON COMMON FUSELAGE

N T FRANK, J K HUFFMAN, and T D JOHNSON, JR (Kenton International, Inc) Dec 1983 59 p refs

(NASA-TM-84618, L-15702, NAS 1 26 84618) Avail NTIS HC

A04/MF A01 CSCL 01A

Positions of the primary vortex flow reattachment line and longitudinal aerodynamic data were obtained at Mach number 0.3 for a systematic series of vortex flaps on delta wing body configurations with leading edge sweeps of 50, 58, 66, and 74 deg. The investigation was performed to study the parametric effects of wing sweep, vortex flap geometry and deflection, canards, and trailing edge flaps on the location of the primary vortex reattachment line relative to the flap hinge line. The vortex reattachment line was located via surface oil flow photographs taken at selected angles of attack. Force and moment measurements were taken over an angle of attack range of -1 deg to 22 deg at zero sideslip angle for many configurations to further establish the data base and to assess the aforementioned parametric effects on longitudinal aerodynamics. Both the flow reattachment and aerodynamic data are presented.

Author

N84-13161*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
INTERNAL PRESSURE DISTRIBUTIONS FOR A TWO-DIMENSIONAL THRUST-REVERSING NOZZLE OPERATING AT A FREE-STREAM MACH NUMBER OF ZERO
 L. E. PUTNAM and E. G. STRONG Dec 1983 45 p refs
 (NASA-TM-85655; L-15582, NAS 1 15 85655) Avail NTIS HC
 A03/MF A01 CSCL 01A

An investigation was conducted in the static test facility of the Langley 16-Foot Transonic Tunnel to measure static pressure distributions inside a nonaxisymmetric thrust reversing nozzle. The tests were made at nozzle total pressures ranging from ambient to about eight times ambient pressure at a free stream Mach number of zero. Tabulated pressure data are presented. Author

N84-13162*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
AERODYNAMIC FORCE MEASUREMENTS WITH A TRAIN-GAGE BALANCE IN A CRYOGENIC WIND TUNNEL
 R. P. BOYDEN, W. G. JOHNSON, JR., and A. T. FERRIS Dec 1983 43 p refs
 (NASA-TP-2251, L-15685, NAS 1 60 2251) Avail NTIS HC
 A03/MF A01 CSCL 01A

Aerodynamic force measurements on a generalized 75 deg delta wing model with sharp leading edges were made with a three component internal strain gage balance in a cryogenic wind tunnel at stagnation temperatures of 300 K, 200 K, and 110 K. The feasibility of using a strain gage balance without thermal control in a cryogenic environment as well as the use of electrical resistance heaters, an insulator between the model and the balance, and a convection shield on the balance was investigated. Force and moment data on the delta wing model as measured by the balance are compared at the different temperatures while holding constant either the Reynolds number or the tunnel stagnation pressure. Tests were made at Mach numbers of 0.3 and 0.5 and at angles of attack up to 29 deg. The results indicate that it is feasible to acquire accurate force and moment data while operating at steady state thermal conditions in a cryogenic wind tunnel, either with or without electrical heaters on the balance. Within the limits of the balance accuracy, there were no apparent Reynolds number effects on the aerodynamic results for the delta wing model. Author

N84-13163*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
THRUST-INDUCED EFFECTS ON SUBSONIC LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF A VECTORED-ENGINE-OVER-WING CONFIGURATION
 P. F. QUINTO and J. W. PAULSON, JR. Dec 1983 56 p refs
 (NASA-TP-2228, L-15629, NAS 1 60 2228) Avail NTIS HC
 A04/MF A01 CSCL 01A

An investigation was conducted in the Langley 4 by 7 Meter Tunnel of the thrust induced effects on the longitudinal aerodynamic characteristics of a vectored-engine-over-wing fighter aircraft. The investigation was conducted at Mach numbers from 0.14 to 0.17 over an angle-of-attack range from -2 deg to 26 deg. The major model variables were the spanwise blowing nozzle sweep angle and main nozzle vector angle along with trailing edge, flap deflections. The overall thrust coefficient (main and spanwise nozzles) was varied from 0 (jet off) to 2.0. The results indicate that the thrust-induced effects from the main nozzle alone were small and mainly due to boundary-layer control affecting a small area behind the nozzle. When the spanwise blowing nozzles were included, the induced effects were larger than the main nozzle alone and were due to both boundary layer control and induced circulation lift. No leading edge vortex effects were evident. Author

N84-13164*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
AERODYNAMIC CHARACTERISTICS, INCLUDING EFFECT OF BODY SHAPE, OF A MACH 6 AIRCRAFT CONCEPT
 G. D. RIEBE Dec 1983 32 p refs
 (NASA-TP-2235, L-15675, NAS 1 60 2235) Avail NTIS HC
 A03/MF A01 CSCL 01A

Longitudinal aerodynamic characteristics for a hydrogen-fueled hypersonic transport concept at Mach 6 are presented. The model components consist of four bodies with identical longitudinal area distributions but different cross-sectional shapes and widths, a wing, horizontal and vertical tails, and a set of wing-mounted nacelles simulated by sled bodies on the wing upper surface. Lift-drag ratios were found to be only slightly affected by fuselage planform width or cross sectional shape. Relative distribution of fuselage volume above and below the wing was found to have an effect on the lift-drag ratio, with a higher lift drag ratio produced by the higher wing position. SCL

N84-13165*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
EFFECT OF THRUST REVERSER OPERATION ON THE LATERAL-DIRECTIONAL CHARACTERISTICS OF A THREE-SURFACE F-15 MODEL AT TRANSONIC SPEEDS
 E. A. BARE and O. C. PENDERGRAFT, JR. Dec 1983 91 p refs
 (NASA-TP-2234, L-15648, NAS 1 60 2234) Avail NTIS HC
 A05/MF A01 CSCL 01A

An investigation was conducted in the Langley 16 Foot Transonic Tunnel to determine the lateral directional aerodynamic characteristics of a fully metric 0.04 scale model of the F-15 three surface configuration (canards, horizontal tails) with twin two dimensional nozzles and twin axisymmetric nozzles installed. The effects of two dimensional nozzle in flight, thrust reversing and rudder deflection were also determined. Test data were obtained at static conditions and at Mach numbers from 0.60 to 1.20 over an angle of attack range from -2 deg to 15 deg. Reynolds number varied from 2.6 million to 3.8 million. Angle of sideslip was set at approximately 0 deg and -5 deg for all configurations and at -10 deg for selected configurations. Author

N84-13166# Nielsen Engineering and Research, Inc., Mountain View, Calif
TRISERVICE PROGRAM FOR EXTENDING MISSILE AERODYNAMIC DATA BASE AND PREDICTION PROGRAM USING RATIONAL MODELING Interim Report, 16 Jun. 1982 - 15 Jun. 1983
 M. J. HEMSCHE and J. N. NIELSEN Aug 1983 81 p
 (Contract N00014-80-C-0700)
 (AD-A132455, NEAR-TR-305; IR-3) Avail NTIS HCA05/MFA01 CSCL 20D

The work described in this report was accomplished during the third year of the Triservice program for extending the missile aerodynamic data base and incorporating the new data into the predictive program known as MISSILE. The work consisted of four aspects: support of the ongoing wind tunnel tests, preparation for processing the data to be incorporated into the data base, methods development, and code development. Author (GRA)

N84-13167# Naval Postgraduate School, Monterey, Calif
AN EXPERIMENTAL INVESTIGATION INTO THE FOREBODY AND ENGINE INLET AIRFLOW CHARACTERISTICS OF A PHOTOGRAPHIC RECONNAISSANCE WINDOW PALLET ON THE RF/A-18 AIRCRAFT M.S. Thesis
 J. W. POOLE Jun 1983 88 p
 (AD-A132271) Avail NTIS HCA05/MFA01 CSCL 20D

A 1/7 scale model of a Navy F/A-18 forebody was built and tested in the Naval Postgraduate School Aeronautics Department Windtunnel to determine and measure the airflow total pressure distribution at the two engine inlet faces. The lower nose of this scaled model was then modified to incorporate a photographic reconnaissance window pallet, capable of holding two camera sensors within the existing gun bay. The model was retested using

03 AIR TRANSPORTATION AND SAFETY

the same pressure measurement parameters and compared with the base aircraft test run to determine the airflow changes entering the engine inlets caused by this nose modification Tufting was used on the model in each case to facilitate flow visualization observations and photography The results of this investigation show that the pallet design tested caused no change in the airflow entering the engine intake ducts at low aircraft airspeeds GRA

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AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations, and aircraft accidents

A84-13387#

HELICOPTER FLIGHT TESTING IN NATURAL SNOW AND ICE
C JONES, M G BATTERSBY, and R J CURTIS (Aeroplane and Armament Experimental Establishment, Salisbury, Wilts, England) AIAA, AHS, IES, SETP, SFTE, and DGLR, Flight Testing Conference, 2nd, Las Vegas, NV, Nov 16-18, 1983 10 p (AIAA PAPER 83-2786)

The safe, effective testing of helicopters in natural icing and snow conditions requires knowledge of the test environment and measurement of the response of the aircraft and its systems to that environment After considerable effort at organisations, Boscombe Down and others, a suite of instrumentation is now available which largely meets these requirements This instrumentation and the techniques for its use are described, together with some results from recent flight trials on a helicopter with an unprotected main rotor The additional instrumentation and test methods required to test helicopters with protected main rotors are also described

Author

A84-14732#

TRANSIENT FLOW ANALYSIS OF AN AIRCRAFT REFUELING SYSTEM
S E PARKS and M E FRANKE Journal of Aircraft (ISSN 0021-8669), vol 20, Dec 1983, p 1033-1036 refs

Transient pressures and flows in an aircraft aerial refueling system are presented for a sudden disconnect between a tanker aircraft and a receiver aircraft Transient conditions are simulated in the tanker refueling system during and after the sudden closure of the poppet valve at the refueling nozzle of the tanker aircraft The simulations are obtained using a transient flow analysis computer program originally developed for hydraulic systems Transient pressure simulations are compared with pressure transients obtained experimentally during ground tests Agreement between the simulations and experiment is obtained Surge arrestors are shown to limit the surge pressure

Author

A84-14778

RELATIONSHIP BETWEEN PHENOLOGICAL PHASE DATA AND THE SEASONAL DISTRIBUTION OF BIRDSTRIKE-INDUCED INCIDENTS AT GERMAN CIVILIAN AIRPORTS [ZUSAMMENHANG ZWISCHEN PHÄNOLOGISCHEN PHASEN/DATEN UND DER SAISONALEN VERTEILUNG VON VOGELSCHLAGBEDINGTEN ZWISCHENFAEELLEN IM BEREICH DER DEUTSCHEN ZIVILFLUGHAEfen]

J HILD (Amt fuer Wehrgeophysik, Traben-Trarbach, West Germany) Meteorologische Rundschau (ISSN 0026-1211), vol 36, Oct. 1983, p 213-218 In German refs

A84-15203*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
OPERATING SAFELY IN ADVERSE WEATHER ENVIRONMENTS

J W STICKLE and A W HALL (NASA, Langley Research Center, Low-Speed Aerodynamics Div, Hampton, VA) International Air Safety Seminar, 36th, Rio de Janeiro, Brazil, Nov 7-10, 1983, Paper 33 p refs

NASA has undertaken three research programs since 1974 that are concerned with the gathering of flight data under adverse and potentially severe weather conditions, such as wind shear, wind turbulence, icing, hail, rain, and lightning All six conditions may be present in a given storm formation Attention is presently given to the B-57B, DHC-6, and F-106B research aircraft employed by these flight data gathering efforts, and the accumulated experience with prediction, remote sensing and weather system penetration methods is discussed Research results are compared with airliner data for 1970-1975 Evidence is found for two electrically active charge centers in thunderstorms, one of which lies at altitudes whose temperature is near the freezing level, and another at higher altitudes, in the temperature range from -25 to -35 C

O C

A84-15417#

THE REDUCTION OF THE FLIGHT ACCIDENT RISK IN GENERAL AVIATION [MINDERUNG DES FLUGUNFALLRISIKOS IN DER ALLGEWEINEN LUFTFAHRT]

R SEIFERT and G OCH (Messerschmitt-Boelkow-Blohm GmbH, Ottobrunn, West Germany) IN Problems and development trends in general aviation, Symposium, Friedrichshafen, West Germany, March 24, 25, 1983, Reports Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1983, p 227-235 In German refs

An investigation was conducted involving the evaluation of aircraft accident data which had been stored by the Accident Data Reporting System The evaluated data were concerned with approximately 1000 aircraft accidents which occurred in West Germany during the time from 1973 to 1978, and with approximately 3400 aircraft accidents occurring in the U S during 1975 Attention is given to the accident rate, the accident cause, and approaches for reducing the accident risk These approaches are concerned with details related to pilot training and instruction, and to procedures for making the pilot 'familiar' with new aircraft types

G R

A84-15418#

ANALYSIS OF INCORRECT HUMAN BEHAVIOR IN FLIGHT ACCIDENTS AND POSSIBILITIES FOR INFLUENCING THIS BEHAVIOR [ANALYSE UND BEEINFLUSSUNGSMOEGLICHKEITEN MENSCHLICHEN FEHLVERHALTENS BEI FLUGUNFAEELLEN]

J MARPMANN IN Problems and development trends in general aviation, Symposium, Friedrichshafen, West Germany, March 24, 25, 1983, Reports Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1983, p 237-243 In German

The present investigation is concerned with approaches for decreasing the role of the human factor in aircraft accidents Accident statistics show that human error is a contributing factor in a very high percentage of aircraft accidents Statistical values regarding this factor are approximately 50 percent for airline traffic, approximately 70 percent for the business air traffic of general aviation, and about 90 percent for sport flyers Attention is given to the man-machine interface, the importance of pilot fitness, a 10-minute pilot exercise program, nutritional recommendations, the avoidance of fatigue, an adequate vacation period, and physical and mental exercises

G R

03 AIR TRANSPORTATION AND SAFETY

N84-12031*# Spectrum Technology, Inc , Virginia Beach, Va
SINGLE PILOT IFR ACCIDENT DATA ANALYSIS
D F HARRIS /n NASA Langley Research Center Controls, Displays and Inform Transfer for Gen Aviation IFR Operations p 25-31 Oct. 1983 refs
Avail NTIS HC A12/MF A01 CSCL 01C

The aircraft accident data recorded by the National Transportation and Safety Board (NTSR) for 1964-1979 were analyzed to determine what problems exist in the general aviation (GA) single pilot instrument flight rule (SPIFR) environment. A previous study conducted in 1978 for the years 1964-1975 provided a basis for comparison. This effort was generally limited to SPIFR pilot error landing phase accidents but includes some SPIFR takeoff and enroute accident analysis as well as some dual pilot IFR accident analysis for comparison. Analysis was performed for 554 accidents of which 39% (216) occurred during the years 1976-1979

Author

N84-12032*# Ohio State Univ , Columbus.
STUDY TO DETERMINE THE IFR OPERATIONAL PROFILE AND PROBLEMS TO THE GENERAL AVIATION PILOT
S WEISLOGEL /n NASA Langley Research Center Controls, Displays and Inform Transfer for Gen Aviation IFR Operations p 33-55 Oct 1983 refs
Avail NTIS HC A12/MF A01 CSCL 01C

A study of the general aviation single pilot operating under instrument flight rules (GA SPIFR) has been conducted for NASA Langley Research Center. The objectives of the study were to (1) develop a GA SPIFR operational profile, (2) identify problems experienced by the GA SPIFR pilot, and (3) identify research tasks which have the potential for eliminating or reducing the severity of the problems. To obtain the information necessary to accomplish these objectives, a mail questionnaire survey of instrument rated pilots was conducted. Complete questionnaire data is reported in NASA CR-165805, 'Statistical Summary: Study to Determine the IFR Operational Profile and Problems of the General Aviation Single Pilot'. Based upon the results of the GA SPIFR survey, this final report presents the general aviation IFR single pilot operational profile, illustrates selected data analysis, examples, identifies the problems which he is experiencing, and recommends further research

Author

N84-12033*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
ANALYSIS OF GENERAL AVIATION SINGLE-PILOT IFR INCIDENT DATA OBTAINED FROM THE NASA AVIATION SAFETY REPORTING SYSTEM
H P BERGERON /n its Controls, Displays and Inform Transfer for Gen Aviation IFR Operations p 57-63 Oct 1983 refs
Avail NTIS HC A12/MF A01 CSCL 01C

An analysis of incident data obtained from the NASA Aviation Safety Reporting System (ASRS) has been made to determine the problem areas in general aviation single-pilot IFR (SPIFR) operations. The Aviation Safety Reporting System data base is a compilation of voluntary reports of incidents from any person who has observed or been involved in an occurrence which was believed to have posed a threat to flight safety. This paper examines only those reported incidents specifically related to general aviation single-pilot IFR operations. The frequency of occurrence of factors related to the incidents was the criterion used to define significant problem areas and, hence, to suggest where research is needed. The data was cataloged into one of five major problem areas (1) controller judgment and response problems, (2) pilot judgment and response problems, (3) air traffic control (ATC) intrafacility and interfacility conflicts, (4) ATC and pilot communication problems, and (5) IFR-VFR conflicts. In addition, several points common to all or most of the problems were observed and reported. These included human error, communications, procedures and rules, and work load

B W

N84-12034*# Ohio State Univ , Columbus
A SUMMARY AND INTEGRATION OF RESEARCH CONCERNING SINGLE PILOT IFR OPERATIONAL PROBLEMS
G C CHAPMAN /n NASA Langley Research Center Controls, Displays and Inform Transfer for Gen Aviation IFR Operations p 65-84 Oct 1983 refs
Avail NTIS HC A12/MF A01 CSCL 01C

A review of seven research studies pertaining to Single Pilot IFR (SPIFR) operations was performed. Two studies were based on questionnaire surveys, two were based on National Transportation Safety Board (NTSB) reports, two were based on Aviation Safety Reporting System (ASRS) incident reports, and one report used event analysis and statistics to forecast problems. The results obtained in each study were extracted and integrated. Results were synthesized and key issues pertaining to SPIFR operations problems were identified. The research that was recommended by the studies and that addressed the key issues is cataloged for each key issue

Author

N84-12137# Army Safety Center, Fort Rucker, Ala
LESSONS LEARNED FROM FY82 US ARMY AVIATION MISHAPS
G D LINDSEY, M J REEDER, C SMITH, and D S RICKETSON, JR Jul 1983 53 p
(AD-A131725, USASC-TR-83-7) Avail NTIS HCA04/MFA01 CSCL 01B

US Army aviation mishap data (96 cases) for FY 82 were analyzed. Lessons learned and corrective actions are identified and presented in Section 1. Section 2 details the results of a survey of three US Army aviation battalion/squadron organization with good safety records. Observation on the factors contributing to their successful safety efforts are provided

Author (GRA)

N84-12138# Federal Aviation Administration, Atlantic City, N J Technical Center
CORRELATION OF LABORATORY-SCALE FIRE TEST METHODS FOR SEAT BLOCKING LAYER MATERIALS WITH LARGE-SCALE TEST RESULTS Final Report, Aug. 1981 - Jun. 1982
L. J BROWN, JR and R M JOHNSON Jun 1983 65 p
(AD-A131666, FAA-CT-83-29) Avail NTIS HCA04/MFA01 CSCL 01C

An interlaboratory study was conducted to determine the adaptability of various laboratory fire test devices to measure aircraft seat cushion blocking layer effectiveness. Full scale tests conducted by the FAA have shown blocking layers to be an effective means of delaying aircraft seat cushion fire involvement when exposed to a large external fuel fire. Large scale tests conducted in the Douglas Aircraft Company Cabin Fire Simulator (CFS) have also shown similar findings. Such findings are fostering development of new candidate materials. However, it is more practical to evaluate these materials in a suitable laboratory test device rather than continuously performing expensive full or large scale tests. Several such devices were determined to be satisfactory when operated under specific conditions and when certain parameters are measured. The satisfactory devices are the Ohio State University (OSU) Rate of Heat Release Apparatus operated at 50 Watts/centimeter squared, the FAA Standard two gallon/hour burner operated for a 2 minute exposure, and the Lockheed Aircraft Company Meeker burner. For a series of blocking layer material candidates, test measurements obtained with the above devices exhibit comparable rankings with weight loss or percent weight loss from larger scale CFS tests

Author (GRA)

03 AIR TRANSPORTATION AND SAFETY

N84-12139# Deutsche Lufthansa Aktiengesellschaft, Frankfurt am Main (West Germany)

ACTIVITIES REPORT OF THE AEROSPACE INDUSTRY IN WEST GERMANY Annual Report, 1980 [DEUTSCHE LUFTHANSA AKTIENGESELLSCHAFT GESCHAFTSBEREICHT 1980]

7 May 1981 58 p refs In GERMAN Original contains color illustrations

Avail NTIS HC A04/MF A01

Surveys by the board of directors, comments on the annual statement of accounts, profit and loss account, capital conservation and investment program, technical progress, and Lufthansa group report are presented

Author (ESA)

N84-12142# National Transportation Safety Board, Washington, D C Bureau of Technology

SAFETY REPORT: GENERAL AVIATION CRASHWORTHINESS PROJECT, PHASE 1 Report, 1972 - 1981

27 Jun 1983 94 p
(PB83-917004, NTSB/SR-83/01) Avail NTIS HC A05/MF A01, HC also available on subscription, North American Continent \$90 00 per year, all others write for quote CSCL 01B

As part of its ongoing work in the area of general aviation crashworthiness, the Safety Board has undertaken a special program of investigation that will provide the real-world data necessary to establish an envelope of typical general aviation accident impact deceleration loads and to describe crash scenarios for a range of general aviation accidents for which design for passenger survivability is feasible. This report, the first of a projected series, explains the Safety Board's crashworthiness program, its objective, and its goals. It presents a description of the crashworthiness analysis methodology used, demonstrates its validity, and provides an example demonstrating its application

GRA

N84-12147# Office of Technology Assessment, Washington, D C

AVIATION GROWTH SCENARIOS

In Its Airport and Air Traffic Control System p 45-63 Jan 1982 Avail SOD HC \$6 00 as 052-003-00873-4

The main focus is on the procedures and assumptions underlying the aviation forecasts on which FAA will base its 1982 system plan. Some sense of the range of possible future demand for aviation facilities and services are provided, in order to assist Congress in making its decisions about long-lived investments in both airports and ATC equipment

Author

N84-13168# National Transportation Safety Board, Washington, D C

AIRCRAFT ACCIDENT REPORT - UNITED AIRLINES FLIGHT 2885, N8053U, MCDONNELL DOUGLAS DC-8-54F, DETROIT, MICHIGAN, JANUARY 11, 1983

31 Aug 1983 62 p
(PB83-910407, NTSB/AAR-83/07) Avail NTIS HC A04/MF A01 CSCL 01C

On January 11, 1983, United Airlines Flight 2885, a McDonnell Douglas DC-8-54F, N8053U, was being operated as a regularly scheduled cargo flight from Cleveland, Ohio, to Los Angeles, California, with an en route stop at Detroit, Michigan. United 2885 departed Cleveland at 0115 and arrived at the Detroit Metropolitan Wayne County Airport at 0152, where cargo for Detroit was unloaded, the airplane was refueled, and cargo for Los Angeles was loaded. At 0249 58, United 2885 called for clearance onto runway 21R and was cleared for takeoff at 0250 03. Visual meteorological conditions prevailed at the time, and the company had filed and been cleared for a standard IFR flight plan. According to witnesses, the takeoff roll was normal, and the airplane rotated to takeoff attitude one-half to two-thirds of the way down runway 21R. After liftoff, the airplane's pitch attitude steepened abnormally, and it climbed to about 1,000 feet above ground level. The airplane then rolled to the right and descended rapidly to the ground. An explosion and fireball occurred at impact. The airplane was destroyed by impact and by the postimpact fire. The flightcrew, consisting of the captain, the first officer, and the second officer,

were killed. The National Transportation Safety Board determines that the probable cause of the accident was the flightcrew's failure to follow procedural checklist requirements and to detect and correct a mistrimmed stabilizer before the airplane became uncontrollable. Contributing to the accident was the captain's allowing the second officer, who was not qualified to act as a pilot to occupy the seat of the first officer and to conduct the takeoff

Author

N84-13169# National Transportation Safety Board, Washington, D C

AIRCRAFT ACCIDENT REPORT - A. E. STALEY MANUFACTURING COMPANY, INC., CANADAIR CHALLENGER CL-600, N805C, HAILEY, IDAHO, JANUARY 3, 1983

7 Sep 1983 35 p
(PB83-910405, NTSB/AAR-83/05) Avail NTIS HC A03/MF A01

About 0910 mountain standard time on January 3, 1983, a Canadair Challenger CL-600, N805C, operated by the A E Staley Manufacturing Company, Inc., Decatur, Illinois, crashed into a mountain about 2 2 nautical miles north of Friedman Memorial Airport, Hailey, Idaho (Sun Valley Airport). At the time, the airplane was proceeding to land at the airport. Shortly before the accident, N805C had completed an instrument flight rules (IFR) flight from Decatur to Sun Valley Airport and had descended in visual flight rules (VFR) flight conditions. The weather at the airport was overcast, ceilings were reported to have been between 800 and 1,500 feet overcast, and the visibility was 10 miles. The base of the clouds were below the tops of the surrounding mountains. N805C missed the airport, flew to the north over the town of Hailey, and into an area of lowering ceilings and worsening visibility. After passing the airport, the pilot attempted to climb above the mountains. The airplane was destroyed during the impact, and the pilot and the copilot, the only persons on board, were killed in the crash. The National Transportation Safety Board determines that the probable cause of the accident was the flightcrew's failure to adhere to the recommended visual arrival procedures for the Sun Valley Airport and its failure to execute timely terrain avoidance actions. The reasons for the flightcrew's failure could not be established conclusively. Contributing to the accident were meteorological conditions and the obscuring of terrain features and landmarks by snow that made navigation by visual references and terrain avoidance difficult

Author

04

AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft, air navigation systems (satellite and ground based), and air traffic control

A84-13388#

A NEW APPROACH TO RECORDING MIL STANDARD 1553B AIRCRAFT BUS DATA

J M KAYE (Ampex Corp., Data Systems Div., Redwood City, CA) AIAA, AHS, IES, SETP, SFTE, and DGLR, Flight Testing Conference, 2nd, Las Vegas, NV, Nov 16-18, 1983 9 p.
(AIAA PAPER 83-2792)

The advent of Mil Standard 1553 is producing changes regarding traditional concepts, according to which military avionics systems have been treated as self-contained subsystems in the aircraft systems environment. The integration of avionics devices can lead to difficulties in connection with troubleshooting and fault finding requirements. Particularly in the development phase of an aircraft's electronics system, a tool was needed which would make it possible to capture and recreate all data signals passing via the MIL-STD-1553 Bus System. A description of the MIL-STD-1553 Interface units is provided. A tape recorder operates as a passive bus monitor while collecting 100 percent of the bus traffic. The 1553B Recorder Interface achieves 100 percent bus recording

capability with a bit error reliability limited only by that of the tape recorder selected
G R.

A84-13847#
AIR TRAFFIC CONTROL AND COLLISION AVOIDANCE SYSTEM AND THEIR APPLICATION TO SHIPS
 K KONDO and S. MIURA Radio Research Laboratories, Review (ISSN 0033-801X), vol 28, Sept 1982, p 585-605 In Japanese, with abstract in English refs

A84-14282#
STRAPDOWN INERTIAL-NAVIGATION SYSTEMS [INERTIALNAVIGATION IN STRAPDOWN TECHNIK]
 D K JOOS (Bodenseewerk Geraetetechnik GmbH, Ueberlingen, West Germany) Ortung und Navigation (ISSN 0474-7550), no 2, 1983, p 165-189 In German refs

The design and testing of strapdown (SD) inertial systems for navigation and aircraft control are surveyed, with a focus on a modular SD system (MSS) developed in the FRG. The requirements of modern commercial and military aircraft are listed, and the capabilities of SD systems are explored. The operating principles of accelerometers, gyroscopes, and overall SD systems are explained, with discussion of the sensor errors and their compensation. It is pointed out that SD design requires great measurement accuracy over a dynamic range of over seven orders of magnitude, the ability to withstand extremes of temperature and vibration, and real-time data processing. The design and static, dynamic, and flight testing of the MSS are reviewed and illustrated with photographs, drawings, and graphs of typical results. A navigational accuracy of 3-4 nautical miles/hour has been attained
T K

A84-14299
A COMPUTERIZED FLIGHT PLAN [LE PLAN DE VOL ORDINATEUR]
 J FOURNIER and J HAMELIN Navigation (Paris) (ISSN 0028-1530), vol 31, Oct 1983, p 411-425 In French

A computerized flight plan service has been organized in Europe to define optimal altitudes along the various flight paths travelled by commercial aircraft. Airline pilots have access to conditions along their precise routes over the continental Europe, selections among various routes to choose the best performance, studies of global flight paths, and free self-service monitoring for last-minute changes. The data can be acquired by telex, Arinc, SITA, and AFTN, with the data arriving in real time. The optimizations are made along regular flight paths, for minimized flight time, and combining the two. Account can be taken of the performance of the aircraft, meteorological data, and pilot flight reports. A sample flight plan and format from New York to Orly is provided
M S K

A84-14300
SECONDARY RADAR SYSTEMS [LES SYSTEMES RADARS SECONDAIRES]
 Navigation (Paris) (ISSN 0028-1530), vol 31, Oct 1983, p 442-448 In French

General principles of the IFF (identify friend or foe) system for radar characterization of the identity of aircraft are reviewed, together with recently implemented equipment. Interrogations from the ground and replies from the aircraft in question are transmitted at frequencies from 1030-1090 MHz in either modes 1 or 2, military or mode 3 code, military or civil. Mode C characterizes the altitude of the aircraft, while mode 4 code is classified and is fixed by encryption. The interrogation code is transmitted at 2 W power pulses separated in time by 0.8 microsec. The aircraft automatically transmits identifying data for the ATC. The interrogation emitter can also be located on aircraft in flight, as can the responder
M S K

A84-14302
FEEDING AND DECOUPLING OF ANTENNA ELEMENTS IN DVOR NAVIGATION EQUIPMENT [SPEISUNG UND ENTKOPPLUNG VON STRAHLERELEMENTEN BEI DVOR-NAVIGATIONSANLAGEN]

W KAUTZ (Standard Elektrik Lorenz AG, Stuttgart, West Germany) Frequenz (ISSN 0016-1136), vol 37, Oct 1983, p 262-268 In German refs

The loading and decoupling systems of a DVOR (Doppler Omnidirectional Radio Range) with 50 sideband antennas are considered. The system as a whole is described and the problem of its interaction with a 39-antenna system is addressed. The solution is presented in terms of the feeding of sideband antennas by uncoupled sources whose internal resistance equals their system characteristic impedance and in which sources the termination of the unexcited antenna uses the same equipment in addition to decoupling equipment
C D

A84-14306#
RESULTS OF THE ITALIAN CNR PROJECT 'NAVIGATION AIDS AND AIR TRAFFIC CONTROL'

F VALDONI (Fondazione Ugo Bordoni, Rome, Italy) Alta Frequenza (ISSN 0002-6557), vol 52, Sept-Oct 1983, p 308-315 refs

The Italian Project 'Navigation Aids and Air Traffic Control', sponsored by the Consiglio Nazionale delle Ricerche, completed all its activities in 1982. The Project consisted of applied researches on a national-wide basis and scheduled to take place over a period of five years. In the paper, the main objectives of the Project and the employed resources are outlined, the attained results are summarized and some final conclusions are stated
Author

A84-14307#
A PROCEDURE FOR THE EUROPEAN ATFM SERVICE
 C BONIVENTO, A TONIELLI (Bologna, Universita, Bologna, Italy), and R PETRIOLI (Fondazione Ugo Bordoni, Rome, Italy) Alta Frequenza (ISSN 0002-6557), vol 52, Sept-Oct 1983, p 316-322 Research supported by the Azienda Autonoma di Assistenza al Volo refs

In this paper an approach to the European ATFM (Air Traffic Flow Management) problem in case of highly diffused congestion is presented. It mainly consists of an interactive software package operationally oriented to solve an optimization problem in which the objective function to be minimized (that is, an accepted overall traffic cost function) and the system constraints are clearly and properly defined in order to achieve the final goal of identifying and deciding flight alternatives, i.e., ground delays and reroutings. Both the general philosophy and its operative utilization in the ATFM environment are presented
Author

A84-14308#
MONOPULSE RECEIVERS FOR ATC BEACON RADAR - ANALYSIS, COMPARISON AND SELECTION CRITERIA

G B GENTILI, D GIULI (Firenze, Universita, Florence, Italy), and G JACOVITTI (Roma, Universita, Rome, Italy) Alta Frequenza (ISSN 0002-6557), vol 52, Sept-Oct 1983, p 323-334 Research supported by the Consiglio Nazionale delle Ricerche refs

In this paper the behavior of three monopulse receivers is analyzed in presence of the principle sources of errors which affect their performances when employed in the SSR systems. In particular statistical parameters are evaluated which characterize both 'internal' (i.e. thermal noise, and mismatchings) and 'external' (i.e. interferences and unwanted propagation effects) sources of error. Finally the intrinsic accuracy and the interference sensitivity of the candidate monopulse receivers are compared on the basis of the above mentioned parameters and criteria for the selection of the monopulse receiver are suggested
Author

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

A84-14309#

REPLY PROCESSING IN MONOPULSE SSR SYSTEM WITH IMPROVED DEGARBLING CAPABILITY

G MARCHETTI, G PICCHI, and L VERRAZZANI (Pisa, Universita, Pisa, Italy) Alta Frequenza (ISSN 0002-6557), vol 52, Sept -Oct 1983, p 335-343 refs

A detailed analysis of the monopulse aided decoding of garbled SSR replies, within a sweep time, is developed in this paper. A degarbling strategy is suggested to obtain a high probability of correct identification, for a given probability of false alarm, of the code pulses pertaining to replies issued from time conflicting aircraft with very small angular separation. It makes use of a confidence threshold level to prevent incorrect identification of information pulses with low signal-to-noise ratios. Extended operating range and good angular resolution result from the proposed reply processing technique. Afterwards design guidelines are developed in parametric form

Author

A84-14310#

PERFORMANCE OF A RECEIVE SIDELOBE SUPPRESSION SYSTEM FOR SECONDARY SURVEILLANCE RADAR

G MARCHETTI, G PICCHI, and L VERRAZZANI (Pisa, Universita, Pisa, Italy) Alta Frequenza (ISSN 0002-6557), vol 52, Sept -Oct 1983, p 344-349 refs

An analysis is presented for the receiver sidelobe suppression function, in a monopulse secondary surveillance radar system having separate main and control antennas. The novel solution is based on the combined processing of the sum, difference and control signals, permitting the generation of a sharp azimuth receiver window, the prevention of mainbeam killing and sidelobe punch-through phenomena, and the detection of interference conditions, thereby avoiding the loss of data carried by garbled mainbeam replies. The present method is expected to have very general application

OC

A84-14311#

ANGLE ESTIMATION AND DISCRIMINATION OF MONOPULSE SSR REPLIES IN THE PRESENCE OF SYNCHRONOUS INTERFERENCE

G BENELLI, M FOSSI, and D GIULI (Firenze, Universita, Florence, Italy) Alta Frequenza (ISSN 0002-6557), vol 52, Sept -Oct 1983, p 350-364 refs

The problem of angle estimation and discrimination of targets in the presence of synchronous interference is considered for the monopulse Secondary Surveillance Radar (SSR) system. The performance of the dwell-time section of the monopulse SSR receiver is analyzed, and evaluated through computer simulations, in the presence of synchronous interference due to garble or horizontal multipath. The conventional algorithm, used in the Discrete Address Beacon System (Mode S), performed by the dwell-time processor for target declaration is considered for this analysis. Suitable statistical parameters are numerically evaluated which give an account of the performance of the considered algorithm in the presence of synchronous interference

Author

A84-14312#

A PACKET SWITCHED DATA LINK FOR AERONAUTICAL BROADCAST CHANNELS

M A MARSAN (Torino, Politecnico, Turin, Italy) Alta Frequenza (ISSN 0002-6557), vol 52, Sept -Oct 1983, p 365-373 Research supported by the Consiglio Nazionale delle Ricerche refs

Simulation results on the performance of an airplane traffic control system that employs a packet switched data link using the same broadcast channel already available for analog voice transmissions are presented. Two alternatives are considered: in the first case it is assumed that no simultaneous voice and data transmission from the same source is possible, in the second case the simultaneous transmission of voice and data from one user is allowed. The performance parameters considered in the study are the average one-way packet delay, and its variance, as well as the percentage of data packets that suffer a collision. It is shown that the proposed system can handle a large number of

airplanes with very good performance in both cases considered

Author

A84-14313#

A VOICE-COMPATIBLE DATA LINK SYSTEM ON THE AERONAUTICAL VHF BAND

N A DANDREA, M MANCIANTI, F RUSSO (CNR, Centro di Studio per i Metodi e i Dispositivi di Radiotrasmissione, Pisa, Italy), R MARGHERI, and M MAZZANTINI (OTE, Florence, Italy) Alta Frequenza (ISSN 0002-6557), vol 52, Sept -Oct 1983, p 374-382 Research supported by the Consiglio Nazionale delle Ricerche refs

In this paper a voice-compatible frequency division data-link system is analyzed to increase the information rate between aircraft and ground-centers. A continuous-phase keying is proposed which allows easy demodulation and negligible voice impairment. Synchronizer and estimator structures are derived and performances evaluated. Moreover, experimental results relevant to practical implementations of both modulator and demodulator are presented

Author

A84-14314#

INTEGRATED VOICE AND DATA COMMUNICATIONS FOR APPLICATIONS TO AIR TRAFFIC CONTROL

G BENELLI, V CAPPELLINI, E DEL RE, and R FANTACCI (Firenze, Universita, Florence, Italy) Alta Frequenza (ISSN 0002-6557), vol 52, Sept -Oct 1983, p 383-388 Research supported by the Consiglio Nazionale delle Ricerche refs

In this work a possible setup of a data link, compatible with voice transmissions, between aircraft and ground stations is proposed. This method utilizes a hybrid amplitude-phase modulation of the same carrier: the amplitude modulation is used for voice transmission, while the phase modulation is for data transmission. This method is particularly simple to implement and requires only slight modifications to the actual on-board equipment for voice transmission. The interferences between the voice and data signals are evaluated through a computer simulation. Some different phase or frequency modulations for data transmissions, such as PSK, FSK and MSK, are considered

Author

A84-14316#

MEASUREMENT SET TO EVALUATE PRIMARY ATC RADAR PERFORMANCE IN THE PRESENCE OF MOVING CLUTTER

G B GENTILI, M FOSSI, D GIULI, G PELOSI, and F PIRRI (Firenze, Universita, Florence, Italy) Alta Frequenza (ISSN 0002-6557), vol 52, Sept -Oct 1983, p 394-406 Research supported by the Consiglio Nazionale delle Ricerche refs

This paper describes some experimental results on spectral behavior of anomalous propagation and rain clutter. The experimental setup for data collection and processing is illustrated. Analysis of azimuth and range sequences is based on MEM (maximum entropy method) spectrum estimation. Such an analysis is used to evaluate error prediction MTI filter performance associated with spectral behavior of recorded phenomena. It is also shown that MEM analysis results can provide a means to overcome some possible MEM shortcomings for spectrum classification

Author

A84-14321#

SATCAS-80 - A NEW GENERATION OF AIR TRAFFIC CONTROL SYSTEMS

B FURCOLO, A SPATOLA, and M TARANTINO (Selenia S p A, Rome, Italy) Alta Frequenza (ISSN 0002-6557), vol. 52, Sept -Oct 1983, p 439-447 Research sponsored by the Istituto Mobiliare Italiano and Consiglio Nazionale delle Ricerche refs

Features of the SATCAS-80 ATC system produced for Italian and export markets are detailed. Attention is given to the modular architecture, project support tools, and logistics of the development of the system. Main subsystems of SATCAS-80 include the radar head, data link, data processing, flight data processing, and the display subsystems. The modularity of SATCAS-80 permits three levels of configurations, depending on the ATC requirements. Notable features of SATCAS-80 comprise adaptive primary radars

with built-in extractor, monopulse secondary radars, radar head tracking, multiradar processing, and the man-machine interface ergonomics SATCAS-80 is scheduled for deployment in actual operation in the near term

M S K

A84-15188* National Aeronautics and Space Administration Flight Research Center, Edwards, Calif

REAL-TIME PILOT GUIDANCE SYSTEM FOR IMPROVED FLIGHT-TEST MANEUVERS

R R MEYER, JR and E T SCHNEIDER (NASA, Flight Research Center, Edwards AFB, CA) AIAA, AHS, IES, SETP, SFTE, and DGLR, Flight Testing Conference, 2nd, Las Vegas, NV, Nov 16-18, 1983 21 p refs

(AIAA PAPER 83-2747)

The Dryden Flight Research Facility has developed a pilot trajectory guidance system that is intended to increase the accuracy of flight-test data and decrease the time required to achieve and maintain desired test conditions, or both. The system usually presented to the pilot computed differences between reference or desired and actual flight state conditions. The pilot then used a cockpit display as an aid to acquire and hold desired test conditions. This paper discusses various flight-test maneuvers and the quality of data obtained using the guidance system. Some comparisons are made between the quality of maneuvers obtained with and without the system. Limited details of the guidance system and algorithms used are included. In general, the guidance system improved the quality of the maneuvers and trajectories flown, as well as allowing trajectories to be flown that would not have been possible without the system. This system has moved from the developmental stage to full operational use in various Dryden research and test aircraft.

Author

A84-15393

RADIO TECHNICAL COMMISSION FOR AERONAUTICS, TECHNICAL SYMPOSIUM AND ANNUAL ASSEMBLY MEETING, WASHINGTON, DC, NOVEMBER 17-19, 1982, PROCEEDINGS
J ALCORN, ED (Radio Technical Commission for Aeronautics, Washington, DC) Washington, DC, Radio Technical Commission for Aeronautics, 1982, 161 p

The application of advanced automation technology to air traffic control (ATC), both on the ground and airborne, is discussed. The aspects addressed include the economics considerations of such application, data communications as the foundation for automation of ATC, and traffic alert collision avoidance systems and the use of Mode S for air-ground information exchange. No individual items are abstracted in this volume

C D

A84-15420*

SYSTEMS FOR REDUCING THE COLLISION RISK FOR GENERAL AVIATION [SYSTEME ZUR MINDERUNG DES KOLLISIONSRISIKOS FUER DIE ALLGEMEINE LUFTFAHRT]
P FORM and W SCHROER (Braunschweig, Technische Universitaet, Brunswick, West Germany) IN Problems and development trends in general aviation, Symposium, Friedrichshafen, West Germany, March 24, 25, 1983, Reports Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1983, p 275-291 In German refs

For more than a decade, possibilities concerning a collision avoidance system have been studied. It appears that such developments have now reached a final phase with advances related to the Traffic Alert and Collision Avoidance System (TCAS) considered by the US Federal Aviation Agency (FAA). The state of TCAS development and related technical boundary conditions are discussed along with the hazards which arise when two aircraft in the air approach each other, taking into account encounters involving distances of less than 200 m. The risk involved depends on the relation between the speed of the two aircraft and angle differences of flight directions. The collision risk can be reduced by providing, in particular, the pilot who is obligated to execute an evasion maneuver with an indication of the vicinity of another aircraft

G R

A84-15422*

ADVANCES RELATED TO RADIO NAVIGATION AIDS FOR CIVIL AVIATION [FORTSCHRITTE BEI FUNKNAVIGATIONSHILFEN FUER DIE ZIVIL-LUFTFAHRT]

H. VOGEL and N. KNOPPIK (Standard Elektrik Lorenz AG, Stuttgart, West Germany) IN Problems and development trends in general aviation, Symposium, Friedrichshafen, West Germany, March 24, 25, 1983, Reports Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1983, p 347-368 In German

The VHF omnirange navigation (VOR) system is used mainly for medium-range flights and in the terminal area. The system was standardized by the International Civil Aviation Organization (ICAO) in 1960. It was initially planned to use VOR until 1985. However, it is expected that the period of its employment will be extended, at least, until the year 2000. The Instrument Landing System (ILS) is a landing aid which is currently used on a worldwide basis. The ICAO has selected the Microwave Landing System (MLS) as successor for the ILS. It is, however, expected that the ILS will be employed until after the year 2000. The equipment currently used in VOR and ILS installations was developed during the time from 1966 to 1970. For competitive reasons the development of new equipment was begun by a company in West Germany in 1979. The performance of the original equipment, the series 3000, and the improvements provided by the new devices, the series 4000, are discussed

G R

A84-15625

AVIONICS/NAVIGATION ARCHITECTURAL DESIGN CONSIDERATIONS

G D HENLEY and T F FIORINO (Intermetrix, Inc., Cambridge, MA) IN NTC '82, National Telesystems Conference, Galveston, TX, November 7-10, 1982, Conference Record New York, Institute of Electrical and Electronics Engineers, Inc., 1982, p A1 21-A1 27 Navy-sponsored research

Consideration is given to the current approaches taken in avionics system design, using as examples the equipment in the F-14A, the F-16, and the F-18 Hornet. Attention is devoted to the design, development, integration, and maintenance of modern-day avionics suites, together with the systems engineering aspects of avionics design. Emphasis is placed on building reliability and maintainability into the systems. Recommendations are presented for early and continued stress on system management concepts, avionics architecture partitioning for reliability and maintenance, system timing function, self-test installment, implementation and management of bus redundancy, enhancement of bus capacity, and use of bus control functions. Significance is also attributed to improving the reliability of nonredundant systems

M S K

A84-15647

INVESTIGATION OF A MICROWAVE SCANNING BEAM LANDING SYSTEM AZIMUTH ERROR SOURCE

P L HARTON (Lockheed Engineering and Management Services Co., Inc., Houston, TX) IN NTC '82, National Telesystems Conference, Galveston, TX, November 7-10, 1982, Conference Record New York, Institute of Electrical and Electronics Engineers, Inc., 1982, p B4 2 1-B4 2 6 refs

The Shuttle Orbiter autoland guidance system is designed to land the Shuttle in a 'hands-off' flight mode. The Microwave Scanning Beam Landing System (MSBLS) is the principal source of position data for this mode of flight. Aircraft flight tests, laboratory range tests, and the orbital flight test program have provided the bases for a rigorous evaluation of MSBLS performance. Aircraft flight tests revealed azimuth errors that are correlated with the aircraft roll angle. Error measurements made at the Lyndon B. Johnson Space Center were used to model the error characteristics. The error mechanism begins with a cross-polarized component of radiation from the ground station antenna and depends significantly upon the thermal protection tile of the Orbiter. Model expressions have been used to predict these cross-polarization errors in the MSBLS measurements along Orbiter landing profiles. Error predictions that were made with the model are presented for an actual Shuttle landing profile. Corrective measures are described

Author

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

A84-15654

GPS FIXED WING FAA EXPLORATORY FLIGHT TEST

J T CONNOR (FAA, Technical Center, Atlantic City, NJ) IN NTC '82, National Telesystems Conference, Galveston, TX, November 7-10, 1982, Conference Record New York, Institute of Electrical and Electronics Engineers, Inc., 1982, p C1 11-C1 18

The Navstar Global Positioning System (GPS) is a satellite based navigation and positioning system. In 1981, the FAA conducted laboratory tests and a 33-hour fixed wing flight program with a single channel GPS receiver, the Z-set. This was done to obtain information for an evaluation of the eventual role of GPS in civil aviation. Attention is given to the laboratory tests, the flight test, aspects of four satellite navigation, navigation based on the use of five or more satellites, three satellite navigation, a comparative analysis, a low-cost antenna test, and GPS channel considerations. On the basis of the obtained results, it is recommended to develop plans on use of remaining GPS channels to maximize and expedite future civil GPS benefits. G R

A84-15835

AN INTEGRATED VOICE-DATA COMMUNICATION SYSTEM FOR VHF LINKS

G BENELLI and R FANTACCI (Firenze, Universita, Florence, Italy) IEEE Transactions on Communications (ISSN 0090-6778), vol COM-31, Dec 1983, p 1304-1308 refs

In this work, a combined amplitude-phase modulation communication system is considered. Amplitude modulation is used to transmit a voice signal, and phase modulation is used for data transmission. Such a scheme was studied as a possible realization of a data channel between aircraft and ground station, which can be introduced without great modifications of the actual on-board equipment. The performance of the combined modulation system is evaluated through a computer simulation. Author

N84-12037*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va

A SIMULATOR EVALUATION OF AN AUTOMATIC TERMINAL APPROACH SYSTEM

D A HINTON *In its* Controls, Displays and Inform Transfer for Gen Aviation IFR Operations p 111-120 Oct 1983 Avail NTIS HC A12/MF A01 CSCL 17G

The automatic terminal approach system (ATAS) is a concept for improving the pilot/machine interface with cockpit automation. The ATAS can automatically fly a published instrument approach by using stored instrument approach data to automatically tune airplane avionics, control the airplane's autopilot, and display status information to the pilot. A piloted simulation study was conducted to determine the feasibility of an ATAS, determine pilot acceptance, and examine pilot/ATAS interaction. Seven instrument-rated pilots each flew four instrument approaches with a base-line heading select autopilot mode. The ATAS runs resulted in lower flight technical error, lower pilot workload, and fewer blunders than with the baseline autopilot. The ATAS status display enabled the pilots to maintain situational awareness during the automatic approaches. The system was well accepted by the pilots. Author

N84-12143# Office of Technology Assessment, Washington, DC

AIRPORT AND AIR TRAFFIC CONTROL SYSTEM

Jan 1982 148 p refs (OTA-STI-175, LC-82-600545) Avail SOD HC \$6 00 as 052-003-00873-4

Needed improvements in the United States Air Traffic Control (ATC) system are discussed. Included are scenarios of future growth in air transportation, alternative ways to increase airport and terminal capacity, technological and economic alternatives to the ATC system modification, and alternatives to the ATC process.

N84-12144# Office of Technology Assessment, Washington, DC

AIRPORT AND AIR TRAFFIC CONTROL SYSTEM. EXECUTIVE SUMMARY

In its Airport and Air Traffic Control System p 3-6 Jan 1982 Avail SOD HC \$6 00 as 052-003-00873-4

Four major topics are examined including scenarios of future growth in air transportation, alternative ways to increase airport and terminal area capacity, technological and economical alternatives to the air traffic control (ATC) system modifications proposed by FAA, and alternatives to the present ATC process. Author

N84-12145# Office of Technology Assessment, Washington, DC

AIRPORT AND AIR TRAFFIC CONTROL SYSTEM. INTRODUCTION AND OVERVIEW

In its Airport and Air Traffic Control System p 9-22 Jan 1982 refs

Avail SOD HC \$6 00 as 052-003-00873-4

The National Airspace System (NAS) includes about 6,500 public-use airports serving nearly all cities and small communities in the United States. Connecting these airports is a network of air routes, defined by navigational aids, that channel the flow of traffic. The growth of air transportation over the remainder of this century is considered. Improvements on the ATC system that affect the safety and capacity of terminal airspace are assessed. Policy options and alternative development plans are identified and analyzed. B G

N84-12146# Office of Technology Assessment, Washington, DC

THE NATIONAL AIRSPACE SYSTEM

In its Airport and Air Traffic Control System p 25-42 Jan 1982 refs

Avail SOD HC \$6 00 as 052-003-00873-4

The National Airspace System (NAS) is a large and complex network of airports, airways, and air traffic control (ATC) facilities that exists to support the commercial, private, and military use of aircraft in the United States. The major parts of the system are examined, both to see how the system operates and to identify factors that may shape its future development. For explanatory purposes, first the goals of the system are considered, and then the system under three major headings: airports, air traffic services, and airspace users. Author

N84-12148# Office of Technology Assessment, Washington, DC

TECHNOLOGY AND THE FUTURE EVOLUTION OF THE ATC SYSTEM

In its Airport and Air Traffic Control System p 67-98 Jan 1982 refs

Avail SOD HC \$6 00 as 052-003-00873-4

An overview of some of the technologies and technological issues that are of concern in decisions that will soon be made about the future development of the ATC system are presented. It is not a detailed treatment of the technological and engineering complexities of the subject, nor does it attempt to resolve any of the related economic and funding controversies. Instead, this discussion is intended to provide decision makers and the public with useful information about the implications of some of the advances in technology that have occurred or which are on the horizon. This information forms a background against which to assess FAA's 1982 revision of the National Airspace System (NAS) Plan. Author

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

N84-12150# Office of Technology Assessment, Washington, D.C.

POLICY IMPLICATIONS

In its Airport and Air Traffic Control System p 125-141 Jan 1982 refs

Avail SOD HC \$6 00 as 052-003-00873-4

The letter from the House Committee on Appropriations requesting an assessment indicated the following areas of concern scenarios of future air transportation growth, alternative ways to increase airport and terminal capacity, proposed modifications of air traffic control (ATC) system technology, and alternatives to the present ATC process. The major points emerging and their implications in terms of congressional interests are summarized and examined. The intent is to highlight those aspects of air system evolution that may be of particular concern to the Congress in evaluating the Federal Aviation Administration's (FAA) 1982 National Airspace System (NAS) Plan

Author

N84-12151*# National Aeronautics and Space Administration Pasadena Office, Calif

HIGH DYNAMIC GLOBAL POSITIONING SYSTEM RECEIVER Patent Application

W J HURD, inventor (to NASA) (JPL, California Inst of Tech., Pasadena) 31 Oct 1983 31 p

(Contract NAS7-100)

(NASA-CASE-NPO-16171-1-CU, US-PATENT-APPL-SN-551536)

Avail NTIS HC A03/MF A01 CSCL 17G

A Global Positioning System (GPS) receiver having a number of channels, receives an aggregate of pseudorange code time division modulated signals. The aggregate is converted to baseband and then to digital form for separate processing in the separate channels. A fast Fourier transform processor computes the signal energy as a function of Doppler frequency for each correlation lag, and a range and frequency estimator computes estimates of pseudorange, and frequency. Raw estimates from all channels are used to estimate receiver position, velocity, clock offset and clock rate offset in a conventional navigation and control unit, and based on the total solution, that unit computes smoothed estimates, for the next measurement interval

NASA

N84-12152# Air Force Wright Aeronautical Labs, Wright-Patterson AFB, Ohio

A COMPARISON OF MANUAL AND VOCAL RESPONSE MODES FOR THE CONTROL OF AIRCRAFT SUBSYSTEMS Final Report, 1 Jan. - 30 Nov. 1982

A J ARETZ Mar 1983 132 p

(Contract AF PROJ 2403)

(AD-A132048, AFWAL-TR-83-3005) Avail NTIS HCA07/MFA01 CSCL 14B

The objective of this study was to determine how a vocal response mode compared to a manual response mode for data entry in a fighter cockpit simulator. Specifically, both vocal and manual response modes were compared in single and dual task conditions on the basis of pilot flight performance, response time, and errors while accomplishing several communication, navigation, and weapons tasks. The results indicated that the manual response mode was more effective than the vocal response mode in terms of response time data, however, the vocal response mode was more effective in terms of flying performance data. These results pointed to a trade off strategy used by the pilots as a function of their current workload. In the dual task manual condition the pilots concentrated on the manual data entry task and flying performance suffered, whereas, in the dual task vocal condition, the pilots kept their attention on the flying task and entered data while maintaining good flight control. As a result, in future fighter aircraft both manual and vocal control should be provided to the pilot for his selection. This conclusion was also supported by questionnaire results in which the pilots favored the implementation of both manual and vocal control

Author (GRA)

N84-12153# European Space Agency, Paris (France)

FLIGHT TESTS FOR A STRAPDOWN SYSTEM (MSS): THE RESULTS OF A SPECIAL FLIGHT TEST

H J HOTOP Jul 1982 42 p refs Transl into ENGLISH of "Flugerprobung eines Strapdown-System (MSS) Darstellung der Ergebnisse am Beispiel eines Versuchsfluges" DFVLR-Mitt-83-02, Brunswick, West Germany, Oct 1982

(ESA-TT-818, DFVLR-MITT-83-02) Avail NTIS HC A03/MF A01, original German version available from DFVLR, Cologne DM 16,60

The instruments and data evaluation procedure for the flight testing of the modular strapdown system are described. Reference data based on an inertial navigation system and optimal smoothing techniques are presented for a test flight of an HFB 320 aircraft. Overall position error is 10 km/hr maximum. Maximum velocity deviation is 8 m/sec, attitude errors are 0.4 deg, heading error drift is 0.4 deg/hr. Alignment error in heading cannot be given since the system was aligned with the aid of the azimuth of the LN3-2A system throughout the test flight series. The MSS system operated without major faults, apart from the switch-overs of the gyroscope measuring ranges, which produce large errors in the heading and attitude during stationary runs

Author (ESA)

N84-13170# Committee on Science and Technology (U S House)

AIRCRAFT NAVIGATION TECHNOLOGY AND ERRORS

Washington GPO 1983 94 p Hearings before the Subcomm on Transportation, Aviation and Mater of the Comm on Sci and Technol, 98th Congr, 1st Sess, no 33, 19 Sep 1983

(GPO-26-859) Avail Subcommittee on Transportation, Aviation and Materials

The issue of aircraft navigation technology and errors is examined. The cause of the KAL 007 incident and ways of preventing such incidents are investigated

S L

N84-13171# Lincoln Lab, Mass Inst of Tech, Lexington

TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM (TCAS): A FUNCTIONAL OVERVIEW OF ACTIVE TCAS I

V A ORLANDO and J D WELCH 8 Apr 1983 32 p

(Contract DOT-FAT72WAI-817)

(AD-A132281, ATC-118, FAA-PM-83-9) Avail NTIS

HCA03/MFA01 CSCL 17G

The Traffic Alert and Collision Avoidance System (TCAS) is a beacon-based airborne collision avoidance system that is able to operate in all airspace without reliance on ground equipment. The TCAS concept encompasses a range of capabilities that include TCAS I, a low-cost, limited-performance version, and TCAS II, which is intended to provide a comprehensive level of separation assurance in all current and predicted airspace environments through the end of this century. This document provides a functional overview of a TCAS I equipped with a low power active transponder detector. It includes a definition of TCAS I functions, calculated and measured surveillance performance for a low power interrogator and an implementation approach that incorporates the TCAS I functions in a Mode S transponder

Author (GRA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

05

AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology

A84-12975

AV-8B FLYING QUALITIES AND PERFORMANCE INTEGRATION FROM DESIGN TO FLIGHT TEST

W W LOWE (McDonnell Douglas Corp, St Louis, MO) (Society of Experimental Test Pilots, Mini-Symposium, San Diego, CA, Apr 15, 16, 1983) Cockpit, vol 18, July-Sept 1983, p 5-11

It is pointed out that the evolution of a truly viable jet V/STOL aircraft for military or civilian use has been hampered by the difficulty in achieving both adequate payloads and satisfactory flying qualities. The design goals of the AV-8B Harrier II are, therefore, mainly related to the development of payload capabilities equivalent to conventional aircraft while ensuring Level I flying qualities throughout its jetborne and wingborne flight envelope. Attention is given to performance improvements, stability and control improvements, and the selected flight test approach. It is found that a total integration of flying quality and performance goals, from design concept to flight test, has proven to be the correct approach for the AV-8B

G R

A84-13335

AQUILA - THE ARMY'S REMOTELY PILOTED VEHICLE PROGRAM

R D EVANS (US Army, Aviation Research and Development Command, St Louis, MO) IN EASCON '82, Annual Electronics and Aerospace Systems Conference, 15th, Washington, DC, September 20-22, 1982, Conference Record New York, Institute of Electrical and Electronics Engineers, 1982, p 375-377

The Army's Remotely Piloted Vehicle (RPV) System performs target acquisition, artillery fire adjustment, target designation, reconnaissance and battle damage assessment from an unmanned air vehicle. The system consists of an air vehicle, ground control station (GCS), remote ground terminal (RGT), launch equipment, recovery equipment and support equipment. Future product improvement plans call for providing a night capability through use of a Forward Looking Infrared (FLIR) sensor package, multi-air vehicle control from a single ground control station, and extended range

Author

A84-13378* Army Research and Technology Labs, Moffett Field, Calif

FREQUENCY-DOMAIN IDENTIFICATION OF XV-13 TILT-ROTOR AIRCRAFT DYNAMICS

M B TISCHLER (US Army, Aeromechanics Laboratory, Moffett Field, CA), J G M LEUNG, and D C DUGAN (NASA, Ames Research Center, Moffett Field, CA) AIAA, AHS, IES, SETP, SFTE, and DGLR, Flight Testing Conference, 2nd, Las Vegas, NV, Nov 16-18, 1983 21 p

(AIAA PAPER 83-2695)

Frequency-domain methods are used to identify the open-loop dynamics of the XV-15 tilt-rotor aircraft from flight tests. Piloting and data analysis techniques are presented to determine frequency response plots and equivalent transfer function models. The open-loop pitch and roll dynamics for the hover flight condition exhibit unstable low-frequency oscillations, whereas the dynamics in the remaining degrees of freedom are lightly damped and generally decoupled. Comparisons of SV-13 flight-test and simulator data are more favorable for high-frequency inputs (omega greater than 10 rad/sec) than low-frequency inputs. The identification of symmetric and asymmetric beam-bending modes compares favorably with previous flight-test data. The results presented in this paper demonstrate the utility of the frequency-domain techniques for dynamics identification and simulator fidelity studies

Author

A84-13381#

BELL-BOEING JVX TILT ROTOR PROGRAM - FLIGHT TEST PROGRAM

T H THOMASON (Bell Helicopter Textron, Fort Worth, TX) AIAA, AHS, IES, SETP, SFTE, and DGLR, Flight Testing Conference, 2nd, Las Vegas, NV, Nov 16-18, 1983 8 p

(AIAA PAPER 83-2726)

In 1982, the Joint Services Advanced Vertical Lift Aircraft Development (JVX) Program was initiated to provide a replacement for several existing helicopters and airplanes in each of the services. The program objectives are related to the development of a common advanced technology vertical lift aircraft capable of meeting multimission service requirements while achieving a significant increase in performance over current aircraft. Maximum mission payload and survivability is to be obtained by providing the JVX TiltRotor with a fly-by-wire flight control system and an all-composite airframe. It is pointed out that the JVX will be the first tilt rotor to complete a full flight qualification program for an operational aircraft. The flight qualification specification is to combine the appropriate requirements for both a helicopter and an airplane

G R

A84-13383#

CLOSING THE LOOP WITH A FLIGHT TEST CUSTOMER - MANAGEMENT AND FOLLOW-UP TECHNIQUES FOR VENDOR OR CUSTOMER FLIGHT TESTING

R K FRINELL (Boeing Technology Services International, Renton, WA) AIAA, AHS, IES, SETP, SFTE, and DGLR, Flight Testing Conference, 2nd, Las Vegas, NV, Nov 16-18, 1983 11 p

(AIAA PAPER 83-2743)

Flight test programs of large commercial aircraft including testing of components such as engines and autopilots for vendors, represent complex and unique program management challenges. Their success usually depends upon adequate planning and application of resources over a long term period. The Boeing Company resources in facilities, skilled manpower, flight test equipment and suitable aircraft availability, make utilization of this resource by vendors attractive. Key decision considerations are identified, along with cost effective methods of support testing, planning, cost control, scheduling, allocation of resources, protection of proprietary data, and other operational considerations are examined

Author

A84-13385#

NON-LINEARITIES ENCOUNTERED IN THE AH-1G HELICOPTER GROUND VIBRATION TEST

E J NAGY (Kaman Aerospace Corp, Bloomfield, CT) AIAA, AHS, IES, SETP, SFTE, and DGLR, Flight Testing Conference, 2nd, Las Vegas, NV, Nov 16-18, 1983 9 p refs

(AIAA PAPER 83-2765)

Extensive ground vibration testing (GVT) of a US Army AH-1G helicopter has been performed at Kaman. During the performance of this work, various nonlinearity effects were encountered. This paper describes the extent of the nonlinearities and the use of relatively high force levels to obtain linear behavior. Results are presented for the calculation of main rotor forces from measured in-flight accelerations and mobility calibration matrices obtained from the GVT. Results are also shown for ground flying wherein the calculated main rotor forces were applied to the test vehicle to duplicate the measured in-flight accelerations

Author

A84-13386#

SPECIAL CONSIDERATIONS FOR TESTING INTEGRATED AVIONIC SYSTEMS

J L BEAN (General Dynamics Corp, Fort Worth, TX) AIAA, AHS, IES, SETP, SFTE, and DGLR, Flight Testing Conference, 2nd, Las Vegas, NV, Nov 16-18, 1983 8 p

(AIAA PAPER 83-2769)

It is pointed out that during the last decade the capabilities of fighter aircraft avionic systems have expanded to the point where traditional testing techniques are no longer adequate. An excellent example of this rapid expansion is provided by the F-16 multirole fighter. It has been found that the high level of integration necessary

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to successfully interface all of the various avionic subsystems will require new methods and tools for the design and test processes. Attention is given to avionic engineering simulators, aspects of in-flight data acquisition, video recording, and real-time monitoring requirements

G R.

A84-13390#

SOVIET AIRCRAFT DESIGN METHODOLOGY

R D WARD (General Dynamics Corp, Fort Worth, TX) American Institute of Aeronautics and Astronautics, Aircraft Design, Systems and Technology Meeting, Fort Worth, TX, Oct 17-19, 1983 7 p (AIAA PAPER 83-2459)

The characteristics of Soviet aircraft design methodology represent a response to political requirements, a severe operating environment, and a structured procurement system. The evolving philosophy of aircraft design utilizes features of design heredity, component commonality, and configuration economy. The characteristic of centralized control results in basically single-role aircraft with limited secondary-role capabilities. Attention is given to the effect of the vast size of the USSR on the aviation requirements, the single-function agencies of the procurement cycle, the use of 'Handbooks for Designers', the employment of unique methods to lessen development risks, an aircraft procurement system which reduces uncertainties, and the investigation of new technologies through experimental rather than analytical means

G R

A84-13392*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

AN EVALUATION OF SUPERSONIC STOVL TECHNOLOGY

G H KIDWELL, JR and B A LAMPKIN (NASA, Ames Research Center, Moffett Field, CA) American Institute of Aeronautics and Astronautics, Aircraft Design, Systems and Technology Meeting, Fort Worth, TX, Oct 17-19, 1983 26 p refs (AIAA PAPER 83-2493)

The purpose of this paper is to document the status of supersonic STOVL aircraft technology. The major focus is the presentation of summaries of pertinent aspects of supersonic STOVL technology, such as justification for STOVL aircraft, current designs and their recognized areas of uncertainty, recent research programs, current activities, plans, etc. The remainder of the paper is an evaluation of the performance differential between a current supersonic STOVL design and three production (or near production) fighters, one of them the AV-8B. The results indicate that there is not a large range difference between a STOL aircraft and a STOVL aircraft, and that other aspects of performance, such as field performance or combat maneuverability, may more than make up for this decrement

Author

A84-13393#

INTEGRATED SYSTEM DESIGN FOR FLIGHT AND PROPULSION CONTROL USING TOTAL ENERGY PRINCIPLES

A A LAMBREGTS (Boeing Commercial Airplane Co, Seattle, WA) American Institute of Aeronautics and Astronautics, Aircraft Design, Systems and Technology Meeting, Fort Worth, TX, Oct 17-19, 1983 12 p (AIAA PAPER 83-2561)

Operational and performance limitations for separately designed flight and propulsion control systems are identified. Design considerations for an integrated flight and propulsion control system are discussed. A design methodology is described using thrust control to satisfy the aircraft's total energy demand represented by flight path and speed targets, and elevator control to satisfy energy distribution and meet the design objectives. The engine control is configured to produce the computed net thrust requirement. This engine control loop and its implications for the flight control system and engine interface are discussed in detail. It is concluded that configuring future electronic engine controls to effectively turn the engine into a 'net thrust actuator,' will greatly enhance future system performance, minimize the effects of engine intermix and eliminate the need for flight control law tailoring and recertification for each specific engine

Author

A84-13394#

MODULAR FIGHTER/HIGH SORTIE RATES AND MISSION FLEXIBILITY

E R SCHULTZ (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, OH) American Institute of Aeronautics and Astronautics, Aircraft Design, Systems and Technology Meeting, Fort Worth, TX, Oct. 17-19, 1983 8 p. (AIAA PAPER 83-2568)

This paper describes a new concept for a tactical fighter which is specifically designed for sustained high sortie rates and mission flexibility. The fighter system consists of two elements. The first element is a high performance but austere basic airframe. The second element is a cluster of pre-serviced modules which contain all of the airborne consumables, selected mechanical/avionics items prone to failure, and special mission items. More modules are provided than airframes, consequently, expended modules can be refurbished while the aircraft is turned around with a previously serviced modular unit. A 'pit stop' approach to aircraft turnaround is discussed. Special techniques for servicing and handling the module are addressed. Existing data are used to indicate the performance gain due to the conformal carriage of all airborne consumables. It is concluded that a modular fighter can provide significant gains in combat productivity through higher sortie rates and improved mission flexibility

Author

A84-13489

THE ROLE OF MODIFICATIONS IN THE DEVELOPMENT OF AVIATION EQUIPMENT [ROL' MODIFIKATSII V RAZVITII AVIATSIONNOI TEKHNIKI]

V M SHEININ and V M MAKAROV Moscow, Izdatel'stvo Nauka, 1982, 225 p. In Russian refs

The theory and history of modifications in aviation engineering and the principal trends in the development of aircraft are reviewed. Topics discussed include the main characteristics of modifications, modification planning, sequential and parallel development of modifications, and criteria for the parametric analysis of the efficiency of modifications. The discussion also covers the history of the modified models of military and commercial aircraft and the effect of modifications on the development of modern aircraft

V L

A84-13724*# National Aeronautics and Space Administration Flight Research Center, Edwards, Calif

X-29 FLIGHT RESEARCH PROGRAM

T W. PUTNAM (NASA, Flight Research Center, Edwards, CA) AIAA, AHS, IES, SETP, SFTE, and DGLR, Flight Testing Conference, 2nd, Las Vegas, NV, Nov 16-18, 1983 14 p refs (AIAA PAPER 83-2687)

The X-29A aircraft is the first manned, experimental high-performance aircraft to be fabricated and flown in many years. The approach for expanding the X-29 flight envelope and collecting research data is described including the methods for monitoring wing divergence, flutter, and aeroservoelastic coupling of the aerodynamic forces with the structure and the flight-control system. Examples of the type of flight data to be acquired are presented along with types of aircraft maneuvers that will be flown. A brief description of the program management structure is also presented and the program schedule is discussed

Author

A84-13725*# National Aeronautics and Space Administration Flight Research Center, Edwards, Calif

PRE-FLIGHT TRANSIENT DYNAMIC ANALYSIS OF B-52 CARRYING SPACE SHUTTLE SOLID ROCKET BOOSTER DROP-TEST VEHICLE

W L KO and L S SCHUSTER (NASA, Flight Research Center, Edwards, CA) AIAA, AHS, IES, SETP, SFTE, and DGLR, Flight Testing Conference, 2nd, Las Vegas, NV, Nov 16-18, 1983 15 p (AIAA PAPER 83-2698)

This paper concerns the transient dynamic analysis of the B-52 aircraft carrying the Space Shuttle solid-rocket booster drop-test vehicle (SRB/DTV). The NASA structural analysis (NASTRAN) finite-element computer program was used in the analysis. The B-52 operating conditions considered for analysis were (1) landing

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and (2) braking on aborted takeoff runs. The transient loads for the B-52 pylon front and rear hooks were calculated. The results can be used to establish the safe maneuver envelopes for the B-52 carrying the SRB/DTV in landings and brakings. Author

A84-13749*# Systems Control Technology, Inc., Palo Alto, Calif

AV-8B SYSTEM IDENTIFICATION RESULTS FROM FULL SCALE DEVELOPMENT FLIGHT TEST PROGRAM

L C ANDERSON, J H VINCENT (Systems Control Technology, Inc., Palo Alto, CA), and B L HILDRETH (U S Navy, Naval Air Test Center, Patuxent River, MD) AIAA, AHS, IES, SETP, SFTE, and DGLR, Flight Testing Conference, 2nd, Las Vegas, NV, Nov 16-18, 1983 10 p
(Contract N00421-81-C-0289, NAS4-2929)

(AIAA PAPER 83-2746)

The results presented in this paper demonstrate a methodology for identification of a non-linear model of the AV-8B V/STOL aircraft from flight test data. Conventional aerodynamics, thrust-induced aerodynamic effects and propulsion model correction factors are identified for hover, transitional and low-speed wingborne flight conditions. A special model formulation is adopted which is continuous at zero airspeed. The identified model is validated by prediction of flight test measurements, and by comparison with wind-tunnel results

Author

A84-13808

MANUFACTURE OF A COMPOSITE MAIN ROTOR BLADE

G B EATON (Westland Helicopters PLC, Yeovil, Somerset, England) IN Reinforced Plastics Congress, 13th, Brighton, Sussex, England, November 8-11, 1982, Proceedings London, British Plastics Federation, 1982, p 55-57

Composite rotor blade construction has been adopted fairly universally with the objective to overcome the limitations of conventional metal rotor blade construction for helicopters both in terms of endurance and battle damage survivability. A description is presented of the design, manufacture, and development of a composite main rotor blade as a retrofit for the Sea King helicopter. Attention is given to the design parameters, the selection of materials, design problems, the prime importance of the automation of manufacture, aspects of quality control, questions of design substantiation, flight testing, and the future role of composites in the aircraft industry

G R

A84-14101

JVX - TILT-ROTOR SETS OUT TO SUCCEED

G WARWICK Flight International (ISSN 0015-3710), vol 124, Nov 5, 1983, p 1214-1220

The Joint Services Advanced Vertical Lift program, designated JVX, has after consideration of various advanced VTOL aircraft concepts chosen the tilt rotor configuration of the XV-15 experimental aircraft. The JVX tilt-rotor is presently in its preliminary design phase, which will end in March 1985. The U S Marine Corps has the largest and most urgent requirement for JVX 552 assault transports that must replace CH-46E and CH-63A/D helicopters. The U S Navy, Air Force and Army, together with the Marine Corps, collectively will require 1086 aircraft, costing \$25 billion. The JVX tilt-rotor will initially fly with T64 turboshafts in order to meet the Marine Corps' 1991 service introduction date. The fuselage, wing, tail, nacelles, and rotors of the aircraft will be constructed from advanced composite materials

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A84-14254

THE MOTION OF THE LANDING SKIS OF AIRCRAFT ALONG THE GROUND. II - THE TAKE-OFF RUN [DVIZHENIE LYZHNYKH OPOR SAMOLETA PO GRUNTU. II - RAZBEG SAMOLETA.]

G S GURA Aviatsionnaya Tekhnika (ISSN 0579-2975), no 2, 1983, p 24-28 In Russian refs

The physicomechanical problems related to the friction effects encountered during the take-off run of aircraft equipped with landing skis are analyzed, and a method is proposed for calculating the resistance to the gliding motion at the start of the run. It is shown that the resistance to the gliding motion can be significantly reduced

by reducing the mass of the snow adhering to the skis. This can be done by using longitudinal vibrating skis or skis with electroosmotic wetting of the friction surface, just before the start, by moisture contained in the ground

V L

A84-14267

SELECTION OF EFFICIENT LANDING GEAR ARRANGEMENTS FOR HEAVY AIRCRAFT BASED ON CONCRETE RUNWAYS [VYBOR RATSIONAL'NYKH KOMPONOVOKHNYKH SKHEM SHASSI TIAZHELYKH SAMOLETOV, BAZIRUIUSHCHIKHSIA NA BETONNYKH VPP]

T M AVDIUKHINA Aviatsionnaya Tekhnika (ISSN 0579-2975), no 2, 1983, p 83-85 In Russian refs

Various landing gear arrangements for heavy aircraft based on concrete runways are analyzed, with the mass of the landing gear used as the efficiency criterion. It is shown that as the number of struts and wheels increases, the mass of the structure somewhat increases, while for a given arrangement there exists an optimum wheel mass. For a 200-t aircraft using four-wheel bogies on the main struts, the optimum number of main wheels is 12. For a similar aircraft using six-wheel bogies, the optimum number of main wheels remains 12, which corresponds to two struts. For a 250-t aircraft, the optimum number of wheels is 16, arranged on four main struts

V L

A84-14269

AN ANALYSIS OF THE MONOCOQUE STRUCTURE OF A SWEPT WING [K RASCHETU KESSONA STRELOVIDNOGO KRYLA]

S N BULATOV and P N KUROCHKA Aviatsionnaya Tekhnika (ISSN 0579-2975), no 2, 1983, p 88-92 In Russian refs

A stress-strain analysis is carried out for a shell modeling the monocoque structure of a swept wing in which the wall thickness varies in accordance with a power law. Two approaches to the analysis of the model are employed: the exact solution and the BBK asymptotic method. It is shown that the curves obtained using the two approaches are practically congruent, and thus the approximate method can be used in designing swept wings of this type

V L

A84-14729*# Purdue Univ, Lafayette, Ind

DYNAMIC STABILITY OF FLEXIBLE FORWARD SWEPT WING AIRCRAFT

T A WEISCHAAR and T A ZEILER (Purdue University, West Lafayette, IN) Journal of Aircraft (ISSN 0021-8669), vol 20, Dec 1983, p 1014-1020 refs
(Contract NAG1-157)

Previously cited in issue 19, p 2977, Accession no A82-39102

A84-14734*# National Aeronautics and Space Administration Flight Research Center, Edwards, Calif

USES OF PARAMETER ESTIMATION IN FLIGHT TEST

K W ILLIF and R E MAINE (NASA, Flight Research Center, Edwards, CA) Journal of Aircraft (ISSN 0021-8669), vol 20, Dec 1983, p 1043-1049 refs

Previously cited in issue 19, p 2977, Accession no A82-39135

A84-14735*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

EFFECTS OF ATMOSPHERIC TURBULENCE ON A QUADROTOR HEAVY LIFT AIRSHIP

M B TISCHLER (NASA, Ames Research Center, Aeromechanics Laboratory, U S Army, Research and Technology Laboratories, Moffett Field, CA) and H R JEX (Systems Technology, Inc., Hawthorne, CA) (Guidance and Control Conference, San Diego, CA, August 9-11, 1982, Collection of Technical Papers p 767-776) Journal of Aircraft (ISSN 0021-8669), vol 20, Dec 1983, p 1050-1057 refs
(Contract NAS2-10330)

Previously cited in issue 19, p 2970, Accession no A82-39009

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

A84-14738#

APPLICATION OF ENERGY SAVING CONCEPTS OF FIGHTER/ATTACK DESIGN

S A POWERS (Vought Corp, Dallas, TX), H H DRIGGERS, and T E KRIEG Journal of Aircraft (ISSN 0021-8669), vol 20, Dec 1983, p 1068-1074

(Contract N622691-81-C-0534)

Previously cited in issue 05, p. 594, Accession no A83-16516

A84-14761

STUDIES ON BLADE-TO-BLADE AND ROTOR-FUSELAGE-TAIL INTERFERENCES

H HUBER and G POLZ (Messerschmitt-Boelkow-Blohm GmbH, Ottobrunn, West Germany) Aircraft Engineering (ISSN 0002-2667), vol 55, Oct 1983, p 2-12 refs

Attention is given to problems arising from the international aerodynamic flow field around advanced helicopter designs, many elements of which involve viscous processes, unsteady flow, and strong interdependence. The first problem presently treated is the blade-to-blade vortex interaction phenomenon, where the unsteady pressure fluctuations due to vortex impacts result in highly impulsive blade loadings, excessive dynamic hub forces and moments, and impulsive noise signatures. The second problem category is that of the interactional aerodynamic flow from the fuselage to the rotor blades, and the third covers interference flow effects between the rotor head and fuselage. For the analytical representation of the steady interference flow, a model containing separated flow calculation is used. Experimental results for steady pressure contours and dynamic pressure and flow angle fluctuations at the empennage/tail rotor area are presented

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A84-14765

ADVANCED FIGHTER TECHNOLOGY - NEW EXPERIMENTAL AIRCRAFT STARTING TO FLY

B SWEETMAN Interavia (ISSN 0020-5168), vol 38, Nov 1983, p 1197-1199

Features of advanced technology fighters being developed in the US are described. Forward-swept wings are being tested on the X-29, together with increased aspect ratio and three-surface longitudinal control. Aeroelastic tailoring is providing required strength for the wing skins, which are made of composite materials. Unstable at low speeds, the X-29 flight will be controlled by a computerized flight control system. Integrated fight/flight control is being tested on an F-16 in concert with an FLIR system for automated high speed low altitude attack flight. Mission-adaptive wings are being installed for flight tests in five modes. Finally, thrust vector control with an advanced nozzle will be tested on an F-16, F-16XL, or an F-18

D H K

A84-14768

SOVIETS DEPLOYING NEW FIGHTERS

C A ROBINSON, JR Aviation Week and Space Technology (ISSN 0005-2175), vol 119, Nov 28, 1983, p 18-20

Rapid deployment is reported for the MiG-31 'Foxhound' interceptor aircraft, which is an improved version of the MiG-25 'Foxbat' with new engines and avionics and an extended range capability. The MiG-31 is equipped with a look-down, shoot-down radar useful for low level interception of cruise missiles. The present report also discloses the design features and projected performance levels of the MiG-29 'Fulcrum' light fighter, which is comparable to the F-16 and F/A-18 US aircraft, and the Su-27 'Flanker' heavy fighter, which is comparable to the US F-15 aircraft. It is noted that the Tupolev 'Blackjack' variable geometry-wing bomber, which has a planned operational capability for 1986, is significantly larger than the only US aircraft with which its mission and performance characteristics are comparable, the B-1 bomber. The U.S.S.R. is producing fighters at the rate of 1,260 aircraft/year

O C

A84-14769

USAF REVIEWS PROGRESS OF NEW FIGHTER PROGRAM

C A ROBINSON, JR Aviation Week and Space Technology (ISSN 0005-2175), vol 119, Nov 28, 1983, p 44-46, 51

Rapid advances in Soviet fighter aircraft avionics/fire control systems, including pulsed look-down radar and long range air-to-air missiles, have prompted the US Air Force's formulation of Advanced Tactical Fighter design guidelines. Attention is presently given to the design concepts with which four leading US military airframe manufacturers have responded to the Air Force's requirements. Three of the four designs are canard configurations, and all employ vectorable thrust nozzles for enhanced transonic maneuverability. The four proposals use up to 60 percent by weight of composite materials in their primary structures, and incorporate very high speed integrated circuit technology in their avionics. Contractors for the Joint Advanced Fighter Engine Program that is associated with the present work will design and demonstrate durable engines for supersonic cruise

O C

A84-15191

NEW FLIGHT DECK DESIGN IN THE LIGHT OF OPERATIONAL CAPABILITIES

R SEIFERT and K BRAUSER (Messerschmitt-Boelkow-Blohm GmbH, Munich, West Germany) NATO, AGARD, Symposium on Flight Mechanics and System Design: Lessons from Operational Experience, Athens, Greece, May 10-14, 1983, Paper 15 p refs (MBB-FE-301/S/PUB/109)

Design considerations and concepts which could take full advantage of the avionics and human factors engineering data bases in the configuration of flight decks for new fighter aircraft are outlined. The design task is to produce a flight deck that fills a pilot's needs and takes advantage of the pilot's capabilities. A Cockpit Data Management concept is introduced that displays function according to the phase and task of a mission, presents feedback on the system and sensor functions, controls the feedback to the pilot on control authority states in the new control modes, monitors task loads, and has fail-safe operation where possible. Human error has been characterized as occurring in action, time, sequence, omission, and addition. New approaches are necessary in order to account for random, rather than systematic, errors. Future flight decks will feature functional flexibility, new performance modes, extended digital avionic and flight control systems, and will detect pilot entry errors

M S K

A84-15389

THE DESIGN OF THE AEROPLANE

D STINTON (Civil Aviation Authority, Airworthiness Div, London, England) New York, Van Nostrand Reinhold Co, 1983, 654 p refs

Attention is given to the aerodynamic and mechanical design principles that are most simply and directly applicable to the flying qualities and performance characteristics of aircraft requiring only a single-pilot crew, using primarily British airworthiness certification criteria. Both piston and turbine powerplants are considered, so that the range of aircraft categories covered encompasses powered hang gliders, motorized gliders, aerobatic biplanes and racing monoplanes, agricultural aircraft, seaplanes, trainers, fighter aircraft, 6/10-scale replicas of W W II aircraft, and short takeoff and landing experimental aircraft. An extensive treatment is undertaken of the consequences for aircraft performance of configurational alternatives

O C

A84-15407#

THE DESIGN OF SPORT AND TOURING AIRCRAFT [DIE AUSLEGUNG VON SPORT- UND REISEFLUGZEUGEN]

R EPPLER and W GUENTHER (Stuttgart, Universitaet, Stuttgart, West Germany) IN Problems and development trends in general aviation, Symposium, Friedrichshafen, West Germany, March 24, 25, 1983, Reports Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1983, p. 13-39. In German

General considerations concerning the design of a new aircraft are discussed, taking into account the objective to develop an aircraft which can satisfy economically a certain spectrum of tasks

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Requirements related to the design of sport and touring aircraft included in the past mainly a high cruising speed and short take-off and landing runs Additional requirements for new aircraft are now low fuel consumption and optimal efficiency A computer program for the computation of flight performance makes it possible to vary automatically a number of parameters, such as flight altitude, wing area, and wing span The appropriate design characteristics are to a large extent determined by the selection of the flight altitude Three different wing profiles are compared Potential improvements with respect to the performance of the aircraft and its efficiency are related to the use of fiber composites, the employment of better propeller profiles, more efficient engines, and the utilization of suitable instrumentation for optimal flight conduction

G R

A84-15408#

THE DESIGN OF HIGH-PERFORMANCE GLIDERS [AUSLEGUNG VON HOCHLEISTUNGSSEGELFLUGZEUGEN]

B MUELLER and V HEUERMANN (Akademische Fliegergruppe, Brunswick, West Germany) IN Problems and development trends in general aviation, Symposium, Friedrichshafen, West Germany, March 24, 25, 1983, Reports Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1983, p 41-61 In German refs

A 'high-performance glider' is defined as a glider which has been designed to carry the pilot in a minimum of time a given distance, taking into account conditions which are as conveniently as possible The present investigation has the objective to show approaches for enhancing the cross-country flight cruising speed, giving attention to the difficulties which the design engineer will have to overcome The characteristics of the cross-country flight and their relation to the cruising speed are discussed, and a description is provided of mathematical expressions concerning the cruising speed, the sinking speed, and the optimum gliding speed The effect of aspect ratio and wing loading on the cruising speed is illustrated with the aid of a graph Trends in glider development are explored, taking into consideration the design of laminar profiles, the reduction of profile-related drag by plain flaps, and the variation of wing loading during the flight A number of suggestions are made for obtaining gliders with improved performance

G R

A84-15409#

THE DESIGN OF LIGHT HELICOPTERS [AUSLEGUNG VON LEICHTHUBSCHRAUBERN]

K SCHYMANIETZ (Messerschmitt-Boelkow-Blohm GmbH, Munich, West Germany) IN Problems and development trends in general aviation, Symposium, Friedrichshafen, West Germany, March 24, 25, 1983, Reports Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1983, p 65-90 In German

The various phases involved in the design of a light helicopter are examined The development of a new helicopter requires approximately eight years The development time can be reduced by making use of already existing components Developments concerning the helicopter market are discussed along with the mission spectrum of the light helicopter, the requirements which have to be satisfied to provide a competitive system, and the need for achieving an optimum design A survey concerning the technology is presented, taking into account the significant trends, expected results, and technological difficulties A description of specific design features for light helicopters are also given An improvement with respect to speed and available space for the payload, under conditions of a simultaneous reduction in fuel consumption, is possible on the basis of improvements related to cell aerodynamics, and new blade profiles and geometries Attention is also given to the use of new materials and maintenance procedures

G R

A84-15410#

THE PROBLEMS OF TYPE CERTIFICATION [DIE PROBLEMATIK DER MUSTERZULASSUNG]

K KOPLIN (Luftfahrt-Bundesamt, Brunswick, West Germany) IN Problems and development trends in general aviation, Symposium, Friedrichshafen, West Germany, March 24, 25, 1983, Reports Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1983, p 91-104 In German

A description is provided of the regulations which have to be satisfied in West Germany to obtain the type certificate for a new aircraft model The West German air law specifies that German aircraft are only permitted to operate if they are certificated for air traffic, and if the prototype of the aircraft has been certificated A necessary condition for this 'type approval' is a test of the prototype aircraft This test is concerned with the demonstration of the reliability of the prototype Details regarding the test of prototype aircraft are discussed, taking into account a comprehensive test, a supplementary test, and a simplified test Attention is also given to the costs involved in obtaining a type certification, acceptance requirements related to noise, problems concerning the import and export of aircraft, and the time required for a type test

G R

A84-15414#

THE DESIGN OF CONTROL FORCES AND THEIR ADAPTATION IN A FLIGHT TEST, TAKING INTO ACCOUNT THE EXAMPLE OF THE DO 228 [ZUR AUSLEGUNG DER STEUERKRAEFT UND IHRER ANPASSUNG IM FLUGVERSUCH AM BEISPIEL DER DO 228]

G HALFMANN and K JONAS (Dornier GmbH, Friedrichshafen, West Germany) IN Problems and development trends in general aviation, Symposium, Friedrichshafen, West Germany, March 24, 25, 1983, Reports Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1983, p 165-191 In German

The parameters which determine the size of the control forces in the case of operation by hand are considered along with the developments which led to the design of the DO 228 The first stage is related to the development of an aircraft wing based on a new technology This development began in West Germany in 1975 Development objectives were a high gliding ratio, an improved rate of climb, and maximum lift obtained with the aid of simple high-lift aids The results of the first part of the project led to the development of the DO 228 with 15 seats, and a longer version of the aircraft with 19 seats Attention is given to the design of the lateral control forces, design aspects related to elevator control, and questions of pedal control

G R

A84-15624

CAML - DIGITAL AVIONICS IN A REAL-TIME APPLICATION

D L HIGHLAND (Lockheed-Georgia Co, Marietta, GA) IN NTC '82, National Telesystems Conference, Galveston, TX, November 7-10, 1982, Conference Record New York, Institute of Electrical and Electronics Engineers, Inc, 1982, p A1 11-A1 15

The digital avionics features of the Cargo Aircraft Mine Laying (CAML) system used by the U S Navy are described CAML is nominally flown in a C-130 and functions by dropping mines into a prespecified area of water Electronic control times and sequences the mine moving operations, provides speed control for all sticks with drive motors, controls the ejector motor, has an operator interface for inputs and updates, and has a self-test and system test Data inputs arrive from 11 tachometers and 12 position sensors, and recordings are made of the number of mines, the exit time, and turn-on time for the ejector motors The automated control algorithm allows an initial push to overcome motor stiction, variable gain as a function of stick weight, and outputs as functions of velocity deviation, motor acceleration, and rate of change velocity An ejector module protects against mine hang-ups

M S K

A84-15850*# National Aeronautics and Space Administration
Flight Research Center, Edwards, Calif
A PROJECT MANAGEMENT SYSTEM FOR THE X-29A FLIGHT TEST PROGRAM

J F STEWART and C A BAUER (NASA, Flight Research Center, Edwards, CA) AIAA, AHS, IES, SETP, SFTE, and DGLR, Flight Testing Conference, 2nd, Las Vegas, NV, Nov 16-18, 1983 11 p refs

(AIAA PAPER 83-2712)

The project-management system developed for NASA's participation in the X-29A aircraft development program is characterized from a theoretical perspective, as an example of a system appropriate to advanced, highly integrated technology projects. System-control theory is applied to the analysis of classical project-management techniques and structures, which are found to be of closed-loop multivariable type, and the effects of increasing project complexity and integration are evaluated. The importance of information flow, sampling frequency, information holding, and delays is stressed. The X-29A system is developed in four stages: establishment of overall objectives and requirements, determination of information processes (block diagrams), definition of personnel functional roles and relationships, and development of a detailed work-breakdown structure. The resulting system is shown to require a greater information flow to management than conventional methods. Sample block diagrams are provided. D G

N84-12057# Federal Ministry for Defence, Bonn (West Germany)

INTEGRATION OF FIRE, FLIGHT AND PROPULSION CONTROL SYSTEMS: AN OVERVIEW, RETROSPECTIVE AND PROSPECTIVE

W M FRAEDRICH *In* AGARD Integration of Fire Control, Flight Control and Propulsion Control Systems 12 p Aug 1983 refs

Avail NTIS HC A09/MF A01

A brief historical review of aviation control technology is presented and topics related to digital data processing are discussed in detail. Problems which may arise with a totally integrated system are demonstrated through the use of examples and strategies for avoiding such problems are suggested. M G

N84-12068# Avions Marcel Dassault, Saint-Cloud (France)
EFFECTS OF INTEGRATED MAINTENANCE ON THE DEFINITIONS OF ONBOARD EQUIPMENTS [REPERCUSSIONS DE LA MAINTENANCE INTEGREE SUR LA DEFINITION DES EQUIPMENTS EMBARQUES]

M COUTOIS *In* AGARD Integration of Fire Control, Flight Control and Propulsion Control Systems 13 p Aug 1983 In FRENCH

Avail NTIS HC A09/MF A01

Equipments for the Mirage 2000 aircraft are related among themselves by a numeric bus centrally controlled by a single tactical (principal) computer. The integrated maintenance of these systems encompasses that realized during the functional operation of the weapon system and is based on permanent surveillance of the equipment operation and the recording of anomalies during flight. In addition, there is a maintenance realized during the particular operation of the weapon system which permits more in-depth tests of the equipment and verifies all information exchanges made by the numeric bus or by point-to-point analog or digital relations. During the maintenance operation, the weapon system no longer provides an operational function. The material and logic implications of the maintainability function accomplished by the equipments are described by distinguishing those arrangements used during functional operation and those used during maintenance. The software for integrated maintenance at the level of the principal computer which controls the numeric bus is described.

Transl by A R H

N84-12077# Boeing Commercial Airplane Co, Seattle, Wash
Aero Research and Development
AERODYNAMIC DESIGN FOR OVERALL VEHICLE PERFORMANCE

I H RETTIE *In* AGARD Spec Course on Subsonic/Transonic Aerodyn Interference for Aircraft 10 p Jul 1983
Avail NTIS HC A13/MF A01

The process by which a wing is designed and integrated into an aircraft configuration is examined in detail. The way in which the characteristics of the design are matched to the size of the aircraft and to the critical segments of typical missions is described with some examples. High-speed computers are used routinely today to determine optimum dimensions for the vehicle. Their growing use in Computational Fluid Dynamics for aerodynamic design prior to wind tunnel testing is examined particularly as regards the capability this offers to tailor a single component such as the wing leading edge to obtain improvements in more than one flight regime by one modification to the aircraft. Author

N84-12078# National Aerospace Lab, Amsterdam (Netherlands)

APPLICATION OF COMPUTATIONAL PROCEDURES IN AERODYNAMIC DESIGN

J W SLOOFF *In* AGARD Spec Course on Subsonic/Transonic Aerodyn Interference for Aircraft 23 p Jul 1983 refs
Avail NTIS HC A13/MF A01

Examples are discussed on the application of computational methods in aerodynamic design problems involving interference. Amongst these are subsonic wing-body, sting support, pylon-nacelle and pylon-store interference, high-lift devices, induced drag minimization through constrained optimization in the Trefftz-plane and transonic wing-fuselage design and analysis. In addition a discussion is given on the problem of optimal usage of aerodynamic soft-ware in analyses and design, requiring an integrated systems approach. Author

N84-12079*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va

TRANSONIC EMPIRICAL CONFIGURATION DESIGN PROCESS

R T WHITCOMB *In* AGARD Spec Course on Subsonic/Transonic Aerodyn Interference for Aircraft 9 p Jul 1983 refs
Avail NTIS HC A13/MF A01

This lecture describes some of the experimental research pertaining to transonic configuration development conducted by the Transonic Aerodynamics Branch of the NASA Langley Research Center. Discussions are presented of the following: use of fluorescent oil films for the study of surface boundary layer flows, the severe effect of wind tunnel wall interference on the measured configuration drag rise near the speed of sound as determined by a comparison between wind tunnel and free air results, the development of a near sonic transport configuration incorporating a supercritical wing and an indented fuselage, designed on the basis of the area rule with a modification to account for the presence of local supersonic flow above the wing, a device for improving the transonic pitch up of swept wings with very little added drag at the cruise condition, a means for reducing the large transonic aerodynamic interference between the wing, fuselage, nacelle and pylon for a fuselage mounted nacelle having the inlet above the wing, and methods for reducing the transonic interference between flows over a winglet and the wing. Author

N84-12081# Messerschmitt-Boelkow-Blohm/Entwicklungsprung Nord, Bremen (West Germany)

TRANSONIC CONFIGURATION DESIGN

G KRENZ *In* AGARD Spec Course on Subsonic/Transonic Aerodyn Interference for Aircraft 26 p Jul 1983 refs
Avail NTIS HC A13/MF A01

General design aspects as well as specific criteria for a transonic wing lay-out are described and some special problems inherent in any transonic wing design are discussed on the basis of wind tunnel measurements. Aerodynamic wing concepts are considered.

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following two different design strategies by model tests in the transonic wind-tunnel. It was found that the shock development on the upper wing surface has a strong effect on both the design and off-design performance of the wing in terms of lift-drag. Potential flow methods used in transonic wing designs are discussed. R J F

N84-12082# British Aerospace Aircraft Group, Preston (England)

TRANSONIC CONFIGURATION DESIGN (FIGHTER)

D E SHAW *In AGARD Spec Course on Subsonic/Transonic Aerodyn Interference for Aircraft* 21 p Jul 1983 refs Avail NTIS HC A13/MF A01

Current design procedures with special reference to aerodynamic interference and the associated use of computational fluid dynamics are discussed. A number of illustrations of various interference phenomena that play a major part in the optimisation of a new design are given. Specifically, the examples given are the detailed effects of twin fins versus single fin, the flap taileron effects on laterals, wing stores, the effects of vortices, and wind tunnel effects with vortices included. R J F

N84-12154* National Aeronautics and Space Administration Langley Research Center, Hampton, Va

SOLAR POWERED AIRCRAFT Patent

W H PHILLIPS, inventor (to NASA) 15 Nov 1983 5 p Filed 15 May 1981 Supersedes N81-32138 (19 - 23, p 3148) (NASA-CASE-LAR-12615-1, US-PATENT-4,415,133, US-PATENT-APPL-SN-263829, US-PATENT-CLASS-244-53R, US-PATENT-CLASS-244-13, US-PATENT-CLASS-244-45R, US-PATENT-CLASS-244-91, US-PATENT-CLASS-244-55) Avail US Patent and Trademark Office CSCL 01C

A cruciform wing structure for a solar powered aircraft is disclosed. Solar cells are mounted on horizontal wing surfaces. Wing surfaces with spanwise axis perpendicular to surfaces maintain these surfaces normal to the Sun's rays by allowing aircraft to be flown in a controlled pattern at a large bank angle. The solar airplane may be of conventional design with respect to fuselage, propeller and tail, or may be constructed around a core and driven by propeller mechanisms attached near the tips of the airfoils. Official Gazette of the US Patent and Trademark Office

N84-12155 Princeton Univ, N J

THE TRACKED WING IN GROUND-EFFECT (TWIG) Ph.D. Thesis

M M K V SANKRITHI 1982 480 p Avail Univ Microfilms Order No DA8305909

The Tracked Wing In Group-Effect (TWIG) is a track-guided aerodynamically levitated vehicle for high speed intercity transportation. This study develops and applies methodologies for the aerodynamic, dynamic, and economic analysis and evaluation of TWIGs. The study starts by outlining some objectives of TWIG design and presenting some alternative TWIG design concepts. Preliminary designs of two roadable TWIGs are made. These comprise a five seat 'TWIGcar' and a forty passenger 'TWIGbus'. An extensive series of aerodynamic theories are developed for the flow between the guideway and the lower surface of a fairly arbitrary TWIG configuration. These treat the lower surface flow as either 2-D or 1-D incompressible potential flow, with account taken of 'Winglet gap leakage flow' around the vehicle sides. Steady and unsteady perturbation solutions are developed. Extensions are made to TWIGs with underbody keels. The aerodynamic theories collectively permit the prediction of frequency dependent longitudinal and lateral aerodynamic generalized stability derivatives, as well as trim and drag characteristics of TWIGs. Dissert Abstr

N84-12156# McDonnell Aircraft Co, St. Louis, Mo
V/STOL (VERTICAL/SHORT TAKEOFF AND LANDING) LOW SPEED AND TRANSITION EQUIVALENT SYSTEMS ANALYSIS Final Report, 20 Sep. 1981 - 20 Sep. 1982
C G CARPENTER and J HODGKINSON Dec 1982 193 p (Contract N62269-81-C-0726) (AD-A131955, NADC-81104-60) Avail NTIS HCA09/MFA01 CSCL 01C

A fixed base manned V/STOL handling qualities simulation was performed to investigate (1) classification criteria of attitude and rate command systems in hover and low-speed flight, (2) control system blending schemes for transition from approach dynamics to hover dynamics and vice versa, and (3) the amount of control usage. Pilot ratings and comments showed that a time response criterion discriminated well between attitude and rate systems, blending schemes for transition correlated well with earlier NASA results and, pilot's command gain had a strong effect on piloting characteristics and the amount of control usage. Author (GRA)

N84-12157# Dayton Univ, Ohio
AIRCRAFT TRANSPARENCY TESTING METHODOLOGY AND EVALUATION CRITERIA. PART 2: METHODOLOGY DEVELOPMENT FOR IMPROVED DURABILITY Final Report, 18 Jan. 1982 - 18 Feb. 1983

K I CLAYTON and B S WEST Apr 1983 51 p (Contract F33615-81-C-3421, AF PROJ 2402) (AD-A131928, UDR-TR-83-25-PT-2, AFWAL-TR-83-3045-PT-2) Avail NTIS HCA04/MFA01 CSCL 01C

A methodology and criteria for testing and evaluating the durability of high performance aircraft transparencies through the use of simulated in-service environments are defined. A realistic and cost-effective durability evaluation criteria is presented for monolithic stretched acrylic, coated monolithic polycarbonate, and acrylic faced/polycarbonate laminate configurations. M G

N84-12158# Dayton Univ, Ohio
AIRCRAFT TRANSPARENCY TESTING METHODOLOGY AND EVALUATION CRITERIA. PART 1: TEST METHODS AND INFORMATION ANALYSIS Final Report, 18 Jan. 1982 - 18 Feb. 1983

K I CLAYTON and B S WEST Apr 1983 68 p (Contract F33615-81-C-3421, AF PROJ 2402) (AD-A131927, UDR-TR-83-25-PT-1, AFWAL-TR-83-3045-PT-1) Avail NTIS HCA04/MFA01 CSCL 01C

A methodology and criteria for testing and evaluating the durability of high performance aircraft transparencies through the use of simulated in-service environments are defined. Relevant information on applicable operational environments, candidate test methods, and previously used simulation/testing techniques are presented and analyzed. Appropriate corrective action is recommended to circumvent knowledge voids and/or test method deficiencies. M G

N84-12159# Dayton Univ, Ohio
ALTERNATE T-38 TRANSPARENCY DEVELOPMENT. PART 4: PARAMETRIC STUDIES Final Report, Jan. 1980 - Feb. 1981

R A NASH and B S WEST Wright-Patterson AFB, Ohio AFWAL Jun 1983 108 p (Contract F33615-76-C-3103, F33615-80-C-3401, AF PROJ 2202; AF PROJ 1926) (AD-A131904, UDR-TR-82-25-PT-4, AFWAL-TR-80-3132-PT-4) Avail NTIS HCA06/MFA01 CSCL 01C

Studies conducted to examine the effect of structural parameter variations on the nonlinear, dynamic response of the T-38 student windshield/support structure system to bird impact are described. The studies were conducted using the materially and geometrically nonlinear analysis (MAGNA) finite element computer program. Both static and transient dynamic analyses were conducted, examining the effects of changes to the transparency and support structure stiffness, intensity of the applied load both coupled and uncoupled, and duration of the impact event. Significant results of the finite element analysis include transparency deflection, peak load versus

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transparency stiffness, and resultant force plots both along the aft arch and around the impact area A discussion of application of the finite element method to the birdstrike problem is also presented
Author (GRA)

N84-12160# Massachusetts Inst of Tech, Cambridge Aeroelastic and Structures Research Labs

REVIEW OF AIRCRAFT CRASH STRUCTURAL RESPONSE RESEARCH Final Report, Aug. 1981 - Aug. 1982

E A WITMER and D J. STEIGMANN Aug 1982 136 p
(Contract F33615-77-C-5155)

(AD-A131696, ASRL-TR-198-1, FAA-CT-82-152) Avail NTIS HCA07/MFA01 CSCL 11D

A review of aircraft crash structural response research has been carried out by studying the literature, discussions with researchers working in that area, and visits to facilities/personnel involved in conducting and/or monitoring aircraft crash structural response investigations Aircraft structures consisting of conventional built-up metallic construction and those consisting of advanced composite materials were of interest The latter type of material and construction is of particular interest since their use is expanding rapidly, and crashworthiness of such structures is of increasing importance Some recent theoretical and experimental studies of the behavior of composite-material structures subjected to severe static, dynamic, and/or impact conditions are noted Such topics as crashworthiness testing of composite fuselage structures, the impact resistance of graphite and hybrid configurations, and the effects of elastomeric additives on the mechanical properties of epoxy resin and composite systems are reviewed A review is made of some current and planned research to investigate experimentally the mechanical failure, postfailure, and energy-absorbing behavior of a sequence of composite-material structural elements and structural assemblages subjected to static loads or to simulated crash-impact loads

GRA

N84-12161# Dayton Univ, Ohio. Research Inst

LONG TERM EVALUATION OF THE EFFECTS OF SHALE OIL PRODUCED JP-4 ON AIRCRAFT CONSTRUCTION MATERIALS

Interim Technical Report, Mar. 1980 - Apr. 1982

B H WILT and J N DUES Wright-Patterson AFB, Ohio AFWAL Apr 1983 53 p

(Contract F33615-82-C-5039, AF PROJ 2421)

(AD-A131665, UDR-TR-83-20, AFWAL-TR-83-4046) Avail NTIS HCA04/MFA01 CSCL 01C

Various fuel system materials including elastomers, structural adhesives, and tank coatings were subjected to accelerated agings in both petroleum produced and shale oil produced JP-4 fuels Comparisons were made of the test results in the different fuels There was no significant difference in the test results for most materials There was, however, significantly more deterioration of buna-N and polyurethane elastomers in shale oil JP-4 than in petroleum derived JP-4 Repeat tests in a second supply of shale oil JP-4 did not result in the buna-N and polyurethane deterioration The results indicate that the first batch of shale oil JP-4 was contaminated although the contaminant could not be identified Subsequent testing will be done with future batches of shale oil JP-4 to insure there is not a problem

GRA

N84-12162# Army Research and Technology Labs, Moffett Field, Calif Aeromechanics Lab

DESIGN CONSIDERATIONS FOR BEARINGLESS ROTOR HUBS

W G BOUSMAN, R A. ORMISTON, and P H MIRICK 1983 28 p

(AD-A131660) Avail NTIS HCA03/MFA01 CSCL 01C

Five studies were performed under contract for concept definition of the integrated technology rotor/flight research rotor (ITR/FRR) Project The purpose of these studies was to examine numerous hub design concepts with the potential of meeting the technical goals and specifications set for the ITR/FRR Thirty three concepts were proposed, including 21 bearingless designs Although the level of effort in these studies was not equivalent to

a preliminary design, many important design issues for advanced rotor hubs were examined, particularly with respect to bearingless rotor designs This paper summarizes the critical aspects of bearingless hub design, they include the design of the flexbeam, the design of a torque structure for pitch control, and the means of augmenting rotor lead lag damping Representative designs from the concept definition studies are used to illuminate these design aspects The capability of the designs to meet the ITR/FRR technical goals is also discussed

GRA

N84-12163# Air Force Wright Aeronautical Labs, Wright-Patterson AFB, Ohio

FLIGHTLINE THERMAL ENVIRONMENT TESTING OF F-111 TRANSPARENCIES Final Technical Report, 1 Nov. 1979 - 20 Aug. 1981

R J SIMMONS Jul 1983 51 p

(Contract AF PROJ 1926)

(AD-A131642, AFWAL-TR-83-3062) Avail NTIS HCA04/MFA01 CSCL 01C

The objective of this effort was to simulate delamination failures occurring on F-111 aircraft located at Cannon AFB, New Mexico The approach used was to simulate the flightline environment at Cannon AFB using existing laboratory test facilities Test procedures and results of the tests are discussed Test results indicated excellent correlation between visible degradation observed in the laboratory specimens and transparencies removed from field service A design modification to combat the delamination failures was tested and proved to be successful Results of bird impact testing of the laboratory tested specimens is presented

GRA

N84-13172*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va

COMPARISON OF LOW-ALTITUDE WIND-SHEAR STATISTICS DERIVED FROM MEASURED AND PROPOSED STANDARD WIND PROFILES

J W USRY Nov 1983 47 p refs

(NASA-TM-85668, L-15619, NAS 1 15 85668) Avail NTIS HC A03/MF A01 CSCL 04B

Wind shear statistics were calculated for a simulated set of wind profiles based on a proposed standard wind field data base Wind shears were grouped in altitude in altitude bands of 100 ft between 100 and 1400 ft and in wind shear increments of 0.025 knot/ft Frequency distributions, means, and standard deviations for each altitude band were derived for the total sample were derived for both sets It was found that frequency distributions in each altitude band for the simulated data set were more dispersed below 800 ft and less dispersed above 900 ft than those for the measured data set Total sample frequency of occurrence for the two data sets was about equal for wind shear values between +0.075 knot/ft, but the simulated data set had significantly larger values for all wind shears outside these boundaries It is shown that normal distribution in both data sets neither data set was normally distributed, similar results are observed from the cumulative frequency distributions

EAK

N84-13173*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio

PERFORMANCE DEGRADATION OF A TYPICAL TWIN ENGINE COMMUTER TYPE AIRCRAFT IN MEASURED NATURAL ICING CONDITIONS

R J RANAUDO, K L MIKKELSEN, R C. MCKNIGHT, and P J PERKINS, JR (Analex Corp) 1984 31 p refs Presented at the 22nd Aerospace Sci Meeting, Reno, Nev., 9-12 Jan 1984, sponsored by AIAA

(NASA-TM-83564, E-1943, NAS 1 15 83564) Avail NTIS HC A03/MF A01 CSCL 01C

The performance of an aircraft in various measured icing conditions was investigated Icing parameters such as liquid water content, temperature, cloud droplet sizes and distributions were measured continuously while in icing Flight data were reduced to provide plots of the aircraft drag polars and lift curves (CL vs alpha) for the measured "iced" condition as referenced to the

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uniced aircraft These data were also reduced to provide plots of thrust horsepower required vs single engine power available to show how icing affects engine out capability It is found that performance degradation is primarily influenced by the amount and shape of the accumulated ice Glaze icing caused the greatest aerodynamic performance penalties in terms of increased drag and reduction in lift while aerodynamic penalties due to rime icing were significantly lower

E A K

N84-13174# Aeronautical Research Labs, Melbourne (Australia)

POWER EFFECTS ON THE LONGITUDINAL CHARACTERISTICS ON SINGLE-ENGINE PROPELLER-DRIVEN AIRCRAFT

C A MARTIN Feb 1983 114 p refs
(ARL-AERO-REPT-157, AR-002-925) Avail NTIS HC A06/MF A01

The effects of power on the longitudinal flying qualities of a single engine propeller driven aircraft were investigated It is shown that the effect on stability of the incidence dependent terms is described by the neutral point ($h_{sub n}$) while the combined incidence and speed terms are described by the static stability limit ($h_{sub s}$) The effects of each power contribution on the longitudinal static and dynamic characteristics of a basic aircraft layout, the standard case are illustrated The influence of aircraft layout and configuration is demonstrated with both power off and power on It is shown that net power effects are sensitive to aircraft layout and can change appreciably when flaps are deflected and propeller power effects are reviewed more theoretical and numerical design methods for most power effects and more wind tunnel and flight tests for the effects of slipstream on tailplane aft are recommended

E A K

N84-13175# Helsinki Univ of Technology, Otaniemi (Finland) Lab of Aerodynamics

RANGE AND ENDURANCE OF JET-ENGINED AIRPLANES AT CONSTANT ALTITUDE

S LAINE 1983 35 p refs
(REPT-83-A1-SER-A, ISBN-951-752-966-X, ISSN-0358-2620)
Avail NTIS HC A03/MF A01

The cruise performance of turbojet and turbofan engined airplanes flying at constant altitude is studied The drag polar is assumed parabolic and independent of Mach number The fuel consumption is assumed to be a linear function of net thrust (i.e., a constant plus a second constant times thrust) Formulas for range and endurance are presented for three different cruising techniques flight at optimum instantaneous velocity, flight at constant angle of attack, and flight at constant velocity Approximate formulas for optimum velocities (maximizing range and endurance) are derived

Author

N84-13176# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

ROTOR SYSTEMS RESEARCH AIRCRAFT: FIXED-WING SIMULATIONS RESULTS

R M KUFELD Dec 1983 16 p refs
(NASA-TM-85863, A-9549, NAS 1 15 85863) Avail NTIS HC A02/MF A01 CSCL 01C

The setup, validation, and results of the Rotor Systems Research Aircraft (RSRA) fixed-wing, moving-base simulation performed in May 1983 are covered The emphasis of the simulation was to familiarize the pilots with the RSRA's fixed-wing configuration Additional information concerning stall speeds, minimum control speed, and various gross weights were recorded and included in the report

Author

N84-13177# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

FLIGHT TESTING THE ROTOR SYSTEMS RESEARCH AIRCRAFT (RSRA)

G W HALL and R K MERRILL Oct 1983 17 p Prepared in cooperation with Army Aviation Engineering Flight Activity, Edwards AFB, Calif
(NASA-TM-85852, A-9510, NAS 1 15 85852, USAAVRADCOM-TM-83-A-1) Avail NTIS HC A02/MF A01 CSCL 01C

In the late 1960s, efforts to advance the state-of-the-art in rotor systems technology indicated a significant gap existed between our ability to accurately predict the characteristics of a complex rotor system and the results obtained through flight verification Even full scale wind tunnel efforts proved inaccurate because of the complex nature of a rotating, maneuvering rotor system The key element missing, which prevented significant advances, was our inability to precisely measure the exact rotor state as a function of time and flight condition Two Rotor Research Aircraft (RSRA) were designed as pure research aircraft and dedicated rotor test vehicles whose function is to fill the gap between theory, wind tunnel testing, and flight verification The two aircraft, the development of the piloting techniques required to safely fly the compound helicopter, the government flight testing accomplished to date, and proposed future research programs

Author

N84-13178# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

PRELIMINARY RESULTS OF THE FIRST STATIC CALIBRATION OF THE RSRA HELICOPTER ACTIVE-ISOLATOR ROTOR BALANCE SYSTEM

C W ACREE, JR Nov 1983 260 p
(NASA-TM-84395, A-9457, NAS 1 15 84395) Avail NTIS HC A12/MF A01 CSCL 01C

The helicopter version of the Rotor Systems Research Aircraft (RSRA) is designed to make simultaneous measurements of all rotor forces and moments in flight analogous to a wind tunnel balance Loads are measured by a combination of load cells, strain gages, and hydropneumatic active isolators which use pressure gages to measure loads Complete evaluation of system performance required calibration of the rotor force and moment measuring system when installed in the aircraft Measurement system responses to rotor loads obtained during the first static calibration of the RSRA helicopter are plotted and discussed Plots of the raw transducer data are included

E A K

N84-13179# Army Aeromedical Research Lab, Fort Rucker, Ala

HELICOPTER IN-FLIGHT MONITORING SYSTEM SECOND GENERATION (HIMS 2) Final Report, Jan. 1981 - Jul. 1983

H D JONES, J A LEWIS, and A A HIGDON, JR Aug 1983 51 p
(Contract DA PROJ 1E1-62777-A-878)
(AD-A132498, USAARL-83-13) Avail NTIS HCA04/MFA01 CSCL 05I

This report presents a description of a computerized airborne data acquisition system used to measure pilot performance in a UH-1 helicopter The unit can record approximately 20 aircraft parameters in addition to other experimental data This report can also serve as an operator's manual for the system

GRA

N84-13180# Naval Postgraduate School, Monterey, Calif

HELICOPTER VERTICAL STABILIZER DESIGN CONSIDERATIONS M.S. Thesis

J E YOUNG Jun 1983 59 p
(AD-A132308) Avail NTIS HCA04/MFA01 CSCL 01C

Helicopter vertical stabilizer design considerations are receiving increasing emphasis from the helicopter community Recent development programs experienced problems with respect to the empennage Naval Postgraduate School Helicopter Design Course sophistication demands inclusion of vertical stabilizer parameters The parameters are addressed in terms of conventional airfoil

design considerations such as airfoils section, planform area, aspect ratio, camber, and sweep back angle. Specific to helicopters is the relationship to the tail rotor. The fundamental design tradeoff is maximum vertical stabilizer size to optimize directional stability and flight with zero tail rotor thrust contrasted to minimum size to optimize tail rotor blockage effects. A conceptual design procedure is developed herein.

Author (GRA)

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AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices, and flight instruments

A84-13384* # Systems Control Technology, Inc., Palo Alto, Calif

THE INTEGRATED SENSOR SYSTEM DATA ENHANCEMENT PACKAGE

T L TRANKLE, W B REED, U. RABIN, and J VINCENT (Systems Control Technology, Inc., Advanced Technology Div., Palo Alto, CA) AIAA, AHS, IES, SETP, SFTE, and DGLR, Flight Testing Conference, 2nd, Las Vegas, NV, Nov 16-18, 1983 10 p refs (Contract NAS2-11391) (AIAA PAPER 83-2758)

The purpose of the Integrated Sensor System (ISS) Data Enhancement Package (DEP) is to improve the accuracies of the data obtained from the inflight tests performed on aircraft. The DEP is a microprocessor-based, flight-qualified electronics package that assimilates data from a Ring Laser Gyro (RLG) system, a standard NASA air data package, and other inputs. The DEP then processes these inputs in real-time to obtain optimal estimates of the aircraft velocity, attitude, and altitude. These estimates can be passed to the flight crew, downlinked, and/or stored on a mass storage medium. The DEP is now being built for the NASA Dryden Flight Research Center. Completion is anticipated in early 1984. A primary use of the ISS/DEP will be for the collection of quality data for the estimation of aircraft aerodynamic coefficients, including stability derivatives, using system identification methods. Initial anticipated applications will be on the AV-8B, F-14, and X-29 test aircraft.

Author

A84-14033* #

THE MODERN FIGHTER COCKPIT

E HERPFER and S KIENLE Dornier-Post (English Edition) (ISSN 0012-5563), no 3, 1983, p 42-46

It is pointed out that a major objective in designing fighters for the 1990s is to simplify control activities through automation and to combine and process the individual display of information in such a way that it is more readily understood by the pilot. Multifunction displays will make possible a reduction of the scanning times by the pilot's eyes through an intelligent combination of sensor, weapons and flight guidance information that will be presented as needed. The displays will also save about 12 electromechanical instruments and will increase operational reliability by showing the information of each display on either of the two other displays. Thus, even if two displays fail, a mission need not be cancelled. To solve the control problem in a one-man cockpit, a concept has been developed that seeks to minimize the control operation. The control concept has three levels of hierarchy: main operating mode selection, interactive control with multifunction displays, and automatic override.

CR

N84-12039* # National Aeronautics and Space Administration Langley Research Center, Hampton, Va

ADVANCED SYMBOLIC FOR GENERAL AVIATION APPROACH TO LANDING DISPLAYS

W H BRYANT *In its* Controls, Displays and Inform Transfer for Gen Aviation IFR Operations p 141-153 Oct 1983 refs Avail NTIS HC A12/MF A01 CSCL 01D

A set of flight tests designed to evaluate the relative utility of candidate displays with advanced symbology for general aviation terminal area instrument flight rules operations are discussed. The symbology was previously evaluated as part of the NASA Langley Research Center's Terminal Configured Vehicle Program for use in commercial airlines. The advanced symbology included vehicle track angle, flight path angle and a perspective representation of the runway. These symbols were selectively drawn on a cathode ray tube (CRT) display along with the roll attitude, pitch attitude, localizer deviation and glideslope deviation. In addition to the CRT display, the instrument panel contained standard turn and bank, altimeter, rate of climb, airspeed, heading, and engine instruments. The symbology was evaluated using tracking performance and pilot subjective ratings for an instrument landing system capture and tracking task.

R JF

N84-12042* # National Aeronautics and Space Administration Langley Research Center, Hampton, Va

A SIMULATOR EVALUATION OF A RATE-ENHANCED INSTRUMENT LANDING SYSTEM DISPLAY

D A HINTON *In its* Controls, Displays and Inform Transfer for Gen Aviation IFR Operations p 171-180 Oct 1983 Avail NTIS HC A12/MF A01 CSCL 01D

A piloted simulation study was conducted to evaluate the effect on instrument landing system tracking performance of integrating localizer error rate information with the raw localizer error display. The resulting display was named the pseudo command tracking indicator (PCTI) because it provides an indication of any changes of heading required to track the localizer. Eight instrument-rated pilots each flew five instrument approaches with the PCTI and five instrument approaches with a conventional course deviation indicator. The results show good overall pilot acceptance of the PCTI and a significant reduction in localizer tracking error.

Author

N84-12044* # Systems Technology, Inc., Hawthorne, Calif

CONTROL/DISPLAY TRADE-OFF STUDY FOR SINGLE-PILOT INSTRUMENT FLIGHT RULE OPERATIONS

R HOH (Milco Intern) *In NASA* Langley Research Center Controls, Displays and Inform Transfer for Gen Aviation IFR Operations p 189-199 Oct 1983 refs Avail NTIS HC A12/MF A01 CSCL 01D

The objectives were to determine minimum autopilot functions and displays required to keep pilot workload at an acceptable level, to determine what constitutes an acceptable level of workload, to identify critical tasks, and to suggest specific experiments required to refine conclusions. It was determined that workload relief is derived from basic stability augmentation, that complex autopilots can lead to serious blunders, and that displays need to enhance positional awareness and minimize the likelihood of false hypothesis.

R JF

N84-12048* # Honeywell, Inc., St Louis Park, Minn

NASA DEMONSTRATION ADVANCED AVIONICS SYSTEM (DAAS)

E M PETERSON *In NASA* Langley Research Center Controls, Displays and Inform Transfer for Gen Aviation IFR Operations p 229-240 Oct 1983 refs

Avail NTIS HC A12/MF A01 CSCL 01D

The Demonstration Advanced Avionics Systems (DAAS) integrates a comprehensive set of general aviation avionics functions into an advanced system architecture for demonstration in a Cessna 402 aircraft. A cursory functional description of the DAAS complex is given. Microprocessors, computer architecture, and display devices are discussed.

R JF

06 AIRCRAFT INSTRUMENTATION

N84-12049*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
AN OVERVIEW OF THE DEMONSTRATION ADVANCED AVIONICS SYSTEM GUEST PILOT EVALUATION CONDUCTED AT AMES RESEARCH CENTER

G P CALLAS, G H HARDY, and D G DENERY /n NASA Langley Research Center Controls, Displays and Inform Transfer for Gen Aviation IFR Operations p 241-265 Oct 1983 refs Avail NTIS HC A12/MF A01 CSCL 01D

The guest pilot flight evaluation of the Demonstration Advanced Avionics System (DAAS) is discussed. The results are based on the fifty-nine questionnaires that were completed by the participants. The primary purpose of the pilot evaluation was to expose the Demonstration Advanced Avionics System to the various segments of the general aviation community and solicit comments in order to determine the effectiveness of integrated avionics for general aviation. Segments of the community that were represented in the evaluation are listed. A total of sixty-four (64) flights were conducted in which one hundred and seventeen (117) pilots and observers participated. It was felt that the exposure each subject had with the DAAS was too short to adequately assess the training requirements, pilot workload, and the reconfiguration concept of the DAAS. It is recommended that an operational evaluation of the DAAS be made to assess the training requirements or varying experience levels, the pilot workload in the ATC environment with unplanned route changes, and the viability of the reconfiguration concept for failures. R J F

N84-12060# Marconi Avionics Ltd, Rochester (England) Airborne Display Div
INTEGRATION OF FIRE CONTROL, NAVIGATION SYSTEM AND HEAD UP DISPLAY

G M BARLING /n AGARD Integration of Fire Control, Flight Control and Propulsion Control Systems 18 p Aug 1983 Avail NTIS HC A09/MF A01

The inclusion of a sophisticated navigation function in a head up display/weapon aiming computer (HUD)/(WAC) is described together with integration of the resultant subsystem into an overall navigation/attack system. A growing trend in airborne systems computing is highlighted. Author

N84-12065# Air Force Flight Dynamics Lab, Wright-Patterson AFB, Ohio
DESIGN AND DEVELOPMENT OF THE MULTIFUNCTION FLIGHT CONTROL REFERENCE SYSTEM

J T YOUNG, J M PERDZOCK, D L SEBRING (McDonnell Douglas Corp), and L EDINGER (Honeywell Inc.) /n AGARD Integration of Fire Control, Flight Control and Propulsion Control Systems 10 p Aug 1983 refs Avail NTIS HC A09/MF A01

The multifunction flight control reference system (MFCRS) concept which uses a minimum number of inertial sensors in a survivable configuration to provide inertial data for flight control, navigation, weapon delivery, cockpit displays, and sensor stabilization is discussed. The MFCRS program was initiated to verify, through flight test, the key issues of redundancy management and flight control. A redundancy management system based on parity equations was designed. It was shown which noise levels were higher than predicted. Additional filtering was required for MFCRS to prevent false alarms and high frequency actuator response. This filtering affected the flight control stability and performance and the flight control design was modified. It is found that integration of inertial data for fire control, flight control, and propulsion control will require close coupling and coordination between functional groups to resolve performance conflicts and compromises. E A K

N84-12066# Ferranti Ltd, Edinburgh (Scotland)
SOME ASPECTS OF FLIGHT TRAJECTORY CONTROL IN FUTURE AVIONIC SYSTEMS FOR COMBAT AIRCRAFT
W H MCKINLAY /n AGARD Integration of Fire Control, Flight Control and Propulsion Control Systems 11 p Aug 1983 refs Avail NTIS HC A09/MF A01

Some of the reasons for increased integration with the emphasis on flight profile control in combat aircraft, largely in the ground attack role are considered. Some of the reasons for further integration involving flight control are examined and the various phases of flight and particular problems are considered. It is suggested that future work will consist of developing particular capabilities, concentrating on the relationship between pilot and total system, learning how to control the design of such a closely coupled system and handling the important problems of testing, reliability, maintainability and the attainment of minimum economic configurations which will satisfy all these goals. The need for flexibility in any system which combines automation with a high degree of pilot participation is stressed. E A K

N84-12067# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst fuer Flugfuehrung
A DIAGNOSIS SCHEME FOR SENSORS OF A FLIGHT CONTROL SYSTEM USING ANALYTIC REDUNDANCY
N STUCKENBERG /n AGARD Integration of Fire Control, Flight Control and Propulsion Control Systems 12 p Aug 1983 refs Avail NTIS HC A09/MF A01

A diagnosis scheme for sensors of a flight control system is presented. Based on analytic redundancy a duplex sensor configuration provides the fail operational capability of a conventional triplex sensor system. This is achieved by using deterministic observers. The feasibility of the presented concept is demonstrated. E A K

N84-12164*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
EVALUATION OF A TOTAL ENERGY-RATE SENSOR ON A TRANSPORT AIRPLANE
A J OSTROFF, R M HUESCHEN, R F HELLBAUM, C M BELCASTRO, and J F CREEDON Nov 1983 48 p refs (NASA-TP-2212, NAS 16 2212, L-15461) Avail NTIS HC A03/MF A01 CSCL 01D

A sensor that measures the rate of change of total energy of an airplane with respect to the airstream has been evaluated. The sensor consists of two cylindrical probes located on the fuselage of a transport airplane, an in line acoustic filter, and a pressure sensing altitude rate transducer. Sections of this report include the sensor description and experimental configuration, frequency response tests, analytical model development, and flight test results for several airplane maneuvers. The results section includes time history comparisons between data generated by the total energy rate sensor and calculated data derived from independent sources. Author

N84-12165# Army Test and Evaluation Command, Aberdeen Proving Ground, Md
TEST OPERATIONS PROCEDURE: ABSOLUTE ALTIMETERS
Final Report
1 Sep 1983 32 p
(AD-A131746, TOP-6-2-013) Avail NTIS HCA03/MFA01 CSCL 14B

This test operations procedure (TOP) delineates general test and specific subtest procedure required to determine the technical performance of absolute altimeters. Absolute altimeters which are used to measure vertical separation between the aircraft and the surface of the Earth, may also be referred to as Radio or Radar altimeters as they determine absolute terrain clearance by measuring the time interval required for a radio frequency signal to travel from the aircraft to the terrain and back again. The TOP is limited to the listed tests which are applicable only to absolute altimeters. The tests will determine Warm-up-Time, Primary Voltage Sensitivity, Mutual Interference, Low Altitude Accuracy and

Resolution, Failsafe, Pitch and Roll, Accuracy and Range, Terrain Tracking, Performance in adverse weather, over icecaps and snow, and under continuous operation

GRA

N84-13181# Lincoln Lab, Mass. Inst of Tech, Lexington
AIRBORNE INTELLIGENT DISPLAY (AID) PHASE 1 SOFTWARE DEVELOPMENT

A C DRUMM, W S HEATH, and J. A RICHARDSON 24 Oct 1983 147 p

(Contract F19628-80-C-0002, DOT-FA77WAI-817)

(ATC-123, FAA-PM-83-30) Avail NTIS HC A07/MF A01

The Airborne Intelligent Display is a microprocessor-based display capable of serving as a cockpit data terminal in a variety of FAA developmental applications. A prototype of this display was developed by Lincoln Laboratory during 1979-1980 in order to evaluate and demonstrate the use of the data link between a Mode S ground sensor and Mode S transponder-equipped aircraft. The AID served as a data link interface allowing the pilot to see, respond to, and initiate communications from a ground sensor. Later, when Lincoln began testing the Traffic Alert and Collision Avoidance System (TCAS), the AID became the TCAS display device, showing position estimates for TCAS-tracked aircraft. More recently, a redesign effort, focused principally on software, was begun to extend the AID design so that it could be more quickly adapted to a variety of FAA developmental programs. This document describes the redesigned Airborne Intelligent Display, with special emphasis on software design.

Author

N84-13182# National Aeronautics and Space Administration Langley Research Center, Hampton, Va.

SIMULATOR STUDY OF PILOT-AIRCRAFT-DISPLAY SYSTEM RESPONSE OBTAINED WITH A THREE-DIMENSIONAL-BOX PICTORIAL DISPLAY

J J ADAMS Dec 1983 52 p refs

(NASA-TP-2122, L-15632, NAS 1 60-2122) Avail NTIS HC A04/MF A01 CSCL 01D

The effect of varying the two important display parameters of a pictorial display on pilot opinion performance, and pilot aircraft display system servomechanism response is examined. The display presents a picture of a three dimensional box that moves along the desired path ahead of the aircraft. The two display parameters examined are the field of view of the picture (from + or - 5 deg to + or - 45 deg) and the distance to the box (from 92 m (300 ft) to 6100 m (20 000 ft)). The results show that the pilots prefer a distance to the box of 915 m (3000 ft) and a field of view of + or - 30 deg. The best performance, both in the sense of quickness of error correction and lowest standard deviation, is obtained with a distance to the box of 92 m (300 ft) and a field of view of + or - 15 deg. A pilot model analysis is used to determine the gains used by the pilots and the servomechanism response characteristics of the pilot aircraft display system.

Author

N84-13183# Naval Aerospace Medical Research Lab, Pensacola, Fla.

THE EFFECTS OF CHARACTER STROKE WIDTH ON THE VISIBILITY OF A HEAD-COUPLED DISPLAY Interim Report

G R BARNES, G. T TURNIPSEED, and F. E GUEDRY, JR

30 Dec 1982 18 p

(Contract NAMRL PROJ M0096)

(AD-A132046, NAMRL-1297) Avail NTIS HCA02/MFA01

CSCL 06S

Experiments on visual-vestibular interaction with head-fixed displays have involved many different display types. This experiment is one of a series directed toward obtaining systematic information of effects of display characteristics on visual performance when man is in motion. When man is required to view a head-fixed display during body movement, his reading performance is degraded because of inadequate suppression of the vestibulo-ocular reflex. An experiment has been conducted to ascertain whether visual performance can be enhanced if the characteristics of a visual display are modified. Subjects were exposed to a 0.025 Hz angular oscillation about the yaw axis with a peak velocity of + or - 120 deg/s. During both the high and low

velocity phases of the waveform there was a significant improvement in reading rate when either the stroke-width of the character was decreased or the inter-character spacing was increased. The results indicate that displays consisting of well-spaced characters composed of bright thin lines are the most suitable for use in vibration conditions.

GRA

N84-13184# Naval Air Test Center, Patuxent River, Md. Systems Engineering Test Directorate

CRASH POSITION INDICATOR/CRASH SURVIVABLE FLIGHT DATA RECORDER EJECTABLE VERSUS NONEJECTABLE

D M WATTERS 27 Jul 1983 28 p

(AD-A132329, AD-F630051, NATC-TM-83-1-SY) Avail NTIS HCA03/MFA01 CSCL 14C

All U.S. military and air carrier aircraft are required to have on board Crash Position Indicator/Crash Survivable Flight Data Recorder/Crash Survivable Cockpit Voice Recorder (CPI/CSFDR/CSCVR) systems. All air carrier aircraft use nonejectable CPI/CSFDR/CSCVR systems. U.S. and Canadian military aircraft use both ejectable and nonejectable CPI/CSFDR/CSCVR systems. Ejectable systems are used on Navy, Marine Corps, and Coast Guard aircraft, primarily because of their overwater mission. Ejectable systems are more complex than nonejectable systems. The reliability, maintainability, and survivability record for both ejectable and nonejectable systems ranges from poor to excellent depending on system design, configuration, and testing. The Search and Rescue (SAR) record for ejectable systems is excellent while the SAR record for nonejectable systems has been relatively poor. The weight, volume, and power requirements for ejectable systems are generally less than for nonejectable systems. The System Safety of all systems is excellent except for the Mortar type (personal hazard if inadvertently ejected on the ground). The acquisition cost of ejectable systems are generally greater than for nonejectable systems. Ejectable CPI/CSFDR/CSCVR systems should be used on aircraft that operate over water. All other aircraft could use either ejectable or nonejectable systems.

GRA

N84-13185# Army Aviation Research and Development Command, St. Louis, Mo.

AN AIRBORNE COLOR VIDEO INSETTER

E A KARCHER and V J ORGANIC Aug 1983 28 p

(AD-A132183, AD-E850405, USAAVRADCOM-TR-83-E-1) Avail NTIS HCA03/MFA01 CSCL 17B

This technical report describes the design, interface, and operation of a general purpose raster scan display Color Video Inserter (CVI) which is capable of airborne operation. The CVI is divided into two independent functions, a color inserter section and a synchronization generation and distribution section. The color inserter which operates on standard red, green, and blue color signals will select one of two background video inputs for display on up to three color monitors and inset into the background externally generated dynamic color features, fixed color features, or both. There is also a separate monitor output to display only the color inset features. The synchronization generation and distribution section is capable of internal generation of television synchronization signals and distribution of these signals to six external users. There is also an external mode in which the synchronization circuitry operates as a distribution amplifier providing six outputs for each of three inputs from an external master synchronization source. Figure 1 shows the front panels of both the CVI and the control units. All input and output lines and control functions are located on these two panels.

GRA

07 AIRCRAFT PROPULSION AND POWER

07

AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors, and on-board auxiliary power plants for aircraft

A84-12792

HEAT TRANSFER IN HIGH-TEMPERATURE GAS TURBINES

E P DYBAN (Akademiia Nauk Ukrainskoj SSR, Institut Tekhnicheskoi Teplofiziki, Kiev, Ukrainian SSR) Heat Transfer - Soviet Research (ISSN 0440-5749), vol 14, July-Aug 1982, p 90-106 Translation refs

Recent studies on heat transfer in high-temperature gas turbines are reviewed, with emphasis placed on some problems of convective heat transfer encountered in the design of air-cooling systems. Topics discussed include perimeter-averaged heat transfer on turbine blade surfaces, local heat transfer on turbine blades, the effect of free-stream turbulence on heat transfer in boundary layers, the effect of longitudinal nonisothermicity of the surface of cooled blades, and heat transfer in zones of transition and separation of the boundary layer. The discussion also covers heat transfer during the blowing of cooling air through blade surfaces operating in a hot gas, heat transfer in impingement cooling, and heat transfer in mass force fields. VL

A84-13429

THE PRESENT AND THE FUTURE OF AIRCRAFT ENGINES [NASTOIASHCHEE I BUDUSHCHEE AVIATSIONNYKH DVIGATELEI]

B A PONOMAREV Moscow, Voenizdat, 1982, 240 p In Russian refs

The design and performance characteristics of modern gas turbine engines for military and commercial aircraft are reviewed. Topics discussed include the operation of gas turbine engines, principal design schemes, the effect of engine operation parameters on the engine design, and major stages in the development of gas turbine engines. Some standard and experimental engines manufactured by American, British, and French companies are characterized. Attention is also given to engines for VTOL, STOL, and pilotless aircraft. Finally, the future prospects for the development and application of gas turbine engines in aviation are examined. VL

A84-13644#

FIFTY YEARS OF EXPERIENCE IN THE SERVICE OF THE PROPULSION OF TOMORROW'S AIRCRAFT [50 JAHRE ERFAHRUNG IM DIENSTE DES ANTRIEBS DER FLUGZEUGE VON MORGEN]

P LACHAUME (Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Paris, France) Tag der Europaeischen Luftfahrt Pioniere, 8th, Bonn, West Germany, May 5, 1983, Paper 61 p In German

The developmental history of turbine aircraft engines in Western Europe is reviewed. Nineteenth-century turbine designs are presented, the rapid sequence of important turbine patents in the 1920's is surveyed, and the stationary tests of the 1930's are listed. The first aircraft engines of both turbojet and turboprop type developed by French, German, British, and Swiss firms during the 1940's are characterized. The primary elements of the progress made since 1950 are found to be in increasing thrust, lowering engine mass and fuel consumption, controlling noise and air pollution, improving reliability and longevity, extending the operational envelope, and decreasing the disturbance sensitivity. Future improvements in the thermodynamic cycle and the efficiency of engine components are predicted. Numerous drawings and graphs illustrate the discussion. TK

A84-13958

A STUDY OF THE VIBRATIONS OF THE BLOWER ROTORS OF GAS-TURBINE ENGINES DURING CHANGES IN THE CONDITIONS AT THE ENGINE INLET [ISSLEDOVANIE KOLEBANII RABOCHIKH KOLES VENTILATOROV GTD PRI IZMENENII USLOVII NA VKHODE V DVIGATEL']

D S ELENEVSKII and V V MALYGIN Problemy Prochnosti (ISSN 0556-171X), Oct 1983, p 81-85 In Russian

The vibrations of blower rotors were investigated during bench testing of aircraft gas-turbine engines fitted with various inlet devices to simulate actual engine inlet conditions in flight. It is found that the various designs of the inlet device, which largely determine the inhomogeneity structure of the gas-dynamic flow at the engine inlet, also determine the type of blower rotor vibration. Resonance modes occur under conditions of maximum symmetry of the inlet air flow, changes in the type of exciting load produce fundamental changes in the general dynamic pattern of the blower rotor. These results apply to engines of different classes. VL

A84-14095

ELECTRONIC CONTROL OF AIRCRAFT TURBINE ENGINE

T SATOH and M KISHIMOTO (Ishikawajima-Harima Heavy Industries Co., Ltd, Aeroengine and Space Development Div, Tokyo, Japan) IHI Engineering Review (ISSN 0018-9820), vol 16, July 1983, p 186-193 refs

Trends in the development of aircraft gas turbine engines and engine control methods are briefly reviewed. Comparative performance data are presented for hydromechanical control systems, systems combining hydromechanical and digital electronic control, and all-digital electronic control systems. The advantages of the latter include improved engine performance, reduced fuel consumption, lower pilot work load, higher reliability, and reduced maintenance costs. The function and configuration of an all-digital control unit for a high-bypass-ratio turbofan engine are discussed. A block diagram of the control unit and test data are presented. VL

A84-15074#

DESIGN OF A REVERSE-FLOW COMBUSTION CHAMBER FOR SMALL GAS TURBINES [CONCEPTION D'UN FOYER AFLUX INVERSEPOUR PETITES TURBOMACHINES]

A MESTRE (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) and G LAGAIN (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, Turbomeca, S A - Brevets Szydlowski, Paris, France) (NATO, AGARD, Symposium on Combustion Problems in Turbine Engines, Cesme, Turkey, Oct 3-7, 1983) ONERA, TP, no 1983-129, 1983, 10 p In French Research supported by the Turbomeca, S A - Brevets Szydlowski (ONERA, TP NO 1983-129)

Bench tests of reverse-flow combustion chambers conducted at atmospheric pressure and with the constrictor removed to allow observation and filming of the flame are reported. Pressure, temperature, and gas concentration were measured at five radial distances. Tables and graphs of the results and drawings of the experimental setup are provided. The injection of the combustion mixture via prevaporization tubes is found to improve the temperature distribution and efficiency while lowering the pollutant emissions. Mechanical-pulverization fuel injection for a few seconds is required to achieve ignition. TK

A84-15194#

APU OPERATIONAL EFFICIENCY

W HOOSE (Messerschmitt-Boelkow-Blohm GmbH, Hamburg, West Germany) NATO, AGARD, Specialist Meeting on Auxiliary Power Systems, Copenhagen, Denmark, May 30, 31, 1983, Paper 16 p (MBB-UT-14-83-OE)

This paper presents some observations based on experience with a new generation of Auxiliary Power Unit (APU) installed in a commercial transport aircraft. The subjects considered are operational requirements and efficiency of the APU. The various operating modes. Particular importance is attached to such matters including the factors determining the APU performance characteristics with respect to a cost effective APU system. These

considerations are conducted with a look at future development trends seen from the point of view of the aircraft manufacturer

Author

A84-15204*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
EFFECTS OF WIND ON TURBOFAN ENGINES IN OUTDOOR STATIC TEST STANDS

J G MCARDLE and A. S MOORE (NASA, Lewis Research Center, Cleveland, OH) AIAA, AHS, IES, SETP, SFTE, and DGLR, Flight Testing Conference, 2nd, Las Vegas, NV, Nov 16-18, 1983 8 p refs

(AIAA PAPER 83-2766)

Wind can affect measured thrust and can cause turbofan engine speed to fluctuate during outdoor testing. Techniques used at an outdoor test stand at NASA Lewis Research Center to make testing easier and faster and to improve data repeatability include using an inflow control device (ICD) to make fan speed steadier, taking many raw data samples for better averaging, and correcting thrust for wind direction and speed. Data from engine tests are presented to show that the techniques improve repeatability of thrust and airflow measurements under various wind conditions. Previously announced in STAR as N83-34945

Author

A84-15205*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
USE OF COOLING AIR HEAT EXCHANGERS AS REPLACEMENTS FOR HOT SECTION STRATEGIC MATERIALS

J W GAUNTNER (NASA, Lewis Research Center, Cleveland, OH) American Institute of Aeronautics and Astronautics, Aircraft Design, Systems and Technology Meeting, Fort Worth, TX, Oct 17-19, 1983 9 p refs

(AIAA PAPER 83-2540)

Because of financial and political constraints, strategic aerospace materials required for the hot section of future engines might be in short supply. As an alternative to these strategic materials, this study examines the use of a cooling air heat exchanger in combination with less advanced hot section materials. Cycle calculations are presented for future turbofan systems with overall pressure ratios to 65, bypass ratios near 13, and combustor exit temperatures to 3260 R. These calculations quantify the effect on TSFC of using a decreased materials technology in a turbofan system. The calculations show that the cooling air heat exchanger enables the feasibility of these engines. Previously announced in STAR as N83-34946

Author

A84-15206*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio
SUPersonic FAN ENGINES FOR MILITARY AIRCRAFT

L C FRANCISCUS (NASA, Lewis Research Center, Cleveland, OH) American Institute of Aeronautics and Astronautics, Aircraft Design, Systems and Technology Meeting, Fort Worth, TX, Oct. 17-19, 1983 10 p refs

(AIAA PAPER 83-2541)

Engine performance and mission studies were performed for turbofan engines with supersonic through-flow fans. A Mach 2.4 CTOL aircraft was used in the study. Two missions were considered: a long range penetrator mission and a long range intercept mission. The supersonic fan engine is compared with an augmented mixed flow turbofan in terms of mission radius for a fixed takeoff gross weight of 75,000 lbm. The mission radius of aircraft powered by supersonic fan engines could be 15 percent longer than aircraft powered with conventional turbofan engines at moderate thrust to gross weight ratios. The climb and acceleration performance of the supersonic fan engines is better than that of the conventional turbofan engines. Previously announced in STAR as N83-34947

Author

A84-15207*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio

STUDY OF A LH2-FUELED TOPPING CYCLE ENGINE FOR AIRCRAFT PROPULSION

G E TURNERY and L H FISHBACH (NASA, Lewis Research Center, Cleveland, OH) American Institute of Aeronautics and Astronautics, Aircraft Design, Systems and Technology Meeting, Fort Worth, TX, Oct 17-19, 1983 19 p refs

(AIAA PAPER 83-2543)

An analytical investigation was made of a topping cycle aircraft engine system which uses a cryogenic fuel. This system consists of a main turboshaft engine which is mechanically coupled (by cross-shafting) to a topping loop which augments the shaft power output of the system. The thermodynamic performance of the topping cycle engine was analyzed and compared with that of a reference (conventional-type) turboshaft engine. For the cycle operating conditions selected, the performance of the topping cycle engine in terms of brake specific fuel consumption (bsfc) was determined to be about 12 percent better than that of the reference turboshaft engine. Engine weights were estimated for both the topping cycle engine and the reference turboshaft engine. These estimates were based on a common shaft power output for each engine. Results indicate that the weight of the topping cycle engine is comparable to that of the reference turboshaft engine. Previously announced in STAR as N83-34942

Author

A84-15904

THE ACCELERATING PACE OF THE ADVANCING TECHNOLOGY OF THE AIRCRAFT ENGINE [DAS BESCHLEUNIGENDE TEMPO FORTSCHREITENDER TECHNOLOGIE DES FLUGZEUGMOTORS]

J F COPLIN (Rolls-Royce, Ltd, Derby, England) European Pioneer's Day, 8th, Bonn, West Germany, May 5, 1983, Paper 46 p In German Research supported by the Ministry of Defence (Procurement Executive)

Trends concerning the jet engine for aircraft are examined. It is found that the current situation of high energy costs provides a powerful motivation for the development of new technology which makes it possible to design jet engines with optimum fuel consumption efficiencies. In order to achieve this objective, it will be necessary to increase the operating temperature of the engine. Such an increase requires the utilization of improved high-temperature materials and further advances with respect to the efficiency of turbine cooling procedures. Possibilities to improve the efficiency of the gas generator as a function of the pressure ratio are considered. In general, an improvement concerning the performance provided by the components appears to be the key to future advances. Here, the situation is similar to that existing in the previous decades. Attention is given to multistage compressors, the aerodynamics of the blower, details of turbine design, advanced turbine materials, and advanced propellers

G R.

N84-12063# British Aerospace Public Ltd Co, Lancashire (England) Advanced Control Systems Group
INTEGRATED POWERPLANT CONTROL SYSTEMS AND POTENTIAL PERFORMANCE BENEFITS

A G SEABRIDGE and R A EDWARDS In AGARD Integration of Fire Control, Flight Control and Propulsion Control Systems 10 p Aug 1983 refs

Avail NTIS HC A09/MF A01

Three aspects of integration in which the powerplant control system was integrated with the aircraft systems were examined. It is shown that the powerplant control system can be progressively integrated into the aircraft systems architecture by a distributed computing system for utility systems management. It is shown that the powerplant control system is a candidate for further improvement as a result of the integration and the ready availability of off take load related data. Some of the advantages of integration with flight control are discussed

E A K

07 AIRCRAFT PROPULSION AND POWER

N84-12064# Dowty and Smith Industries Controls Ltd, Cheltenham (England)

FULL AUTHORITY DIGITAL ELECTRONIC ENGINE CONTROLS AND THEIR INTEGRATION WITH FLIGHT CONTROL SYSTEMS IN VSTOL AIRCRAFT

E S ECCLES *In* AGARD Integration of Fire Control, Flight Control and Propulsion Control Systems 10 p Aug 1983 refs Avail NTIS HC A09/MF A01

The architecture and construction of the system applied to the Pegasus engine and aimed at the AV8B application are described. The system's architecture was determined by the requirements of a single engined VSTOL aircraft. It is essentially a dual-dual system. This architecture was chosen to provide reliable and positive detection of failure with rapid reaction and no degradation of performance. The likely extension of this system to the control of plenum chamber burning (PCB) is discussed. E A K

N84-12166*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio

A GENERALIZED COMPUTER CODE FOR DEVELOPING DYNAMIC GAS TURBINE ENGINE MODELS (DIGTEM)

C J DANIELE Nov 1983 18 p refs To be presented at the Aerospace Conf, San Diego, Calif, 2-3 Feb 1984 (NASA-TM-83508, NAS 1 15 83508, E-1853) Avail NTIS HC A02/MF A01 CSCL 21E

This paper describes DIGTEM (digital turbofan engine model), a computer program that simulates two spool, two stream (turbofan) engines. DIGTEM was developed to support the development of a real time multiprocessor based engine simulator being designed at the Lewis Research Center. The turbofan engine model in DIGTEM contains steady state performance maps for all the components and has control volumes where continuity and energy balances are maintained. Rotor dynamics and duct momentum dynamics are also included. DIGTEM features an implicit integration scheme for integrating stiff systems and trims the model equations to match a prescribed design point by calculating correction coefficients that balance out the dynamic equations. It uses the same coefficients at off design points and iterates to a balanced engine condition. Transients are generated by defining the engine inputs as functions of time in a user written subroutine (TMRSP). Closed loop controls can also be simulated. DIGTEM is generalized in the aerothermodynamic treatment of components. This feature, along with DIGTEM's trimming at a design point, make it a very useful tool for developing a model of a specific turbofan engine. B W

N84-12167# Ames Lab, Iowa

PROGRESS ON ULTRASONIC FLAW SIZING IN TURBINE-ENGINE ROTOR COMPONENTS: BORE AND WEB GEOMETRIES

J H ROSE, T A GRAY, R B THOMPSON, and J L OPSAL (California Univ, Lawrence Livermore Lab) 1983 31 p refs Presented at the Conf on Quantitative NDE, Santa Cruz, Calif, 7-12 Aug 1983

(Contract W-7405-ENG-82) (DE83-018081, IS-M-445, CONF-830811-9) Avail NTIS HC A03/MF A01

The application of generic flaw-sizing techniques to specific components generally involves difficulties associated with geometrical complexity and simplifications arising from a knowledge of the expected flaw distribution. This paper is concerned with the case of ultrasonic flaw sizing in turbine-engine rotor components. The sizing of flat penny-shaped cracks in the web geometry discussed and new crack-sizing algorithms based on the Born and Kirchhoff approximations are introduced. Additionally, we propose a simple method for finding the size of a flat, penny-shaped crack given only the magnitude of the scattering amplitude. The bore geometry is discussed with primary emphasis on the cylindrical focusing of the incident beam. Important questions which are discussed include the effects of diffraction and the position of the flaw with respect to the focal line. The appropriate deconvolution procedures to account for these effects are introduced. Generic features of the theory are compared with

experiment. Finally, the effects of focused transducers on the Born inversion algorithm are discussed. DOE

N84-12168# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France)

AUXILIARY POWER SYSTEMS

Loughton, England Sep 1983 228 p refs In ENGLISH and FRENCH Meeting held in Copenhagen, 30-31 May 1983 (AGARD-CP-352, ISBN-92-835-0339-2) Avail NTIS HC A11/MF A01

The state-of-the-art of aircraft auxiliary power systems for electrical, hydraulic, and pneumatic subsystems is reviewed. The advantages and problems associated with such systems are defined and future design improvements are identified.

N84-12169# Bundesministerium der Verteidigung, Bonn (West Germany)

AUXILIARY POWER REQUIREMENTS: THEIR ROLE IN AIRCRAFT PERFORMANCE

E W ECKERT *In* AGARD Auxiliary Power Systems 17 p Sep 1983

Avail NTIS HC A11/MF A01

Based on the historical development and the actual status of requirements, the trends of essential parameters are analyzed, physical and technical possibilities are assessed and a prognosis is offered. Increasing demands for secondary power for subsystems and more powerful engines have led to stronger secondary power components, thus creating a mass problem. Energy losses add a thermal problem. Complexity rises rapidly with the number of inputs and outputs. All of this, together with such aspects as redundancy, reliability, safety, maintainability and life cycle cost, composes today's auxiliary power system. The future system, in response to high performance requirements and budgetary and personnel restrictions, should aim at less complexity and more efficiency.

Author

N84-12170# Societe Microturbo, Toulouse (France)

AUXILIARY POWER SYSTEMS WITH GAS TURBINES [GROUPES AUXILIAIRES A TURBINE A GAZ]

A ROMIER and P CALMELS *In* AGARD Auxiliary Power Systems 8 p Sep 1983 In FRENCH

Avail NTIS HC A11/MF A01

Gas turbine auxiliary power systems were developed to meet the demand for aircraft autonomy during their use for checklist, conditioning from the ground, and main engine starting. Solutions developed in the military and civil domains for a short operational pure start system are examined as well as an auxiliary system with continued operation. Present trends on modern aircraft where the starting system is capable of continued operation are considered. Future needs that can be predicted as a function of the growing complexity of onboard weapons systems which require ground conditioning, the development of principal reactors imposing ever more important starting power, and operation as a help in the flight domain with extremely reduced time of use are explored.

Transl by A R H

N84-12171# KHD Luftfahrttechnik G m b H, Oberursel (West Germany)

SECONDARY POWER SYSTEMS FOR FIGHTER AIRCRAFT EXPERIENCES TODAY AND REQUIREMENTS FOR A NEXT GENERATION

W HAUSMANN, M PUCHER, and T WEBER *In* AGARD Auxiliary Power Systems 15 p Sep 1983 refs

Avail NTIS HC A11/MF A01

The necessary of a continuous increase of fighting efficiency of weapon systems sets forth a number of new requirements for the next generation of military aircraft in particular regarding the distribution and use of the onboard auxiliary power. Energy conversion methods have to be applied which are readily adaptable to operation requirements and also favour the thermal balance of the aircraft. As an example of the pneumatic energy conversion the efficiency of an auxiliary system is presented together with a listing of those factors which play a role in its optimization. Design

concepts and options available for future systems are presented. Experience derived from a modern fighter aircraft system serves as a basis for discussion of advanced requirements and design features

Author

N84-12172# Solar Turbines International, San Diego, Calif
Turbomach

SMALL AUXILIARY POWER UNIT DESIGN CONSTRAINTS

C RODGERS /n AGARD Auxiliary Power Systems 19 p Sep 1983 refs

Avail NTIS HC A11/MF A01

Self-sufficiency for military aircraft operating from remote advanced bases can be attained with small on-board air breathing gas turbine auxiliary power units (APUs) supplying main engine start and aircraft secondary power. The small, fixed shaft, gas turbine configuration comprising the single-stage radial compressor and radial inflow turbine, mounted back-to-back, and overhung from a cold end bearing capsule has found favor in providing this duty due to inherent attributes of low costs, simplicity and high power-to-weight ratio. Extensive experience with these APUs has led to the formulation of several major design constraints, within the objective of minimum life cycle costs, that enhance development of both modified and derivative versions. Some of these design constraints are discussed and advantageous areas of research and development for future APUs are identified

Author

N84-12173# KLM Royal Dutch Airlines, Amsterdam (Netherlands)

APU IN COMMERCIAL AIRLINE OPERATION

H W C L SCHOEVERS and A. BOOY /n AGARD Auxiliary Power Systems 9 p Sep 1983

Avail NTIS HC A11/MF A01

Advantages and disadvantages of incorporating auxiliary power units in commercial aircraft are discussed. Reliability, maintenance and weight costs, and fuel savings are specifically addressed. The auxiliary power unit (APU) provides pneumatic and electrical power on the ground for operation of the air conditioning and electrical systems and for starting the main engines. Operation and control are fully automatic after start initiation, making a better use of the manpower available. Since the airplane's air packs are run, the APU can provide a cooler aircraft at boarding time on hot days than ground equipment. Moreover, individual temperature control of the cabin sections is possible. The APU reduces dependence on ground equipment availability and reliability, thus enhancing on-time performance. It reduces the quantity of required ramp equipment, thus reducing ramp congestion and consequently turn-around time. Even a water system may fall in this category. On some aircraft availability of the APU may be used to replace a failing engine generator during specific flight phases

M G

N84-12174# ABG-Semca S.A., Toulouse (France)

AUXILIARY POWER UNITS FOR WIDE-BODY AIRCRAFT

S RIAZUELO, M CENIVAL (Turboomeca, Bizanos, France), and M EGLEM /n AGARD Auxiliary Power Systems 14 p Sep 1983

Avail NTIS HC A11/MF A01

Existing auxiliary power units for wide body aircraft are described with individual consideration given to the power section, accessory gear box, load compressor, and digital electronic regulation modules. Requirements for future designs of such systems are identified

M G

N84-12175# British Aerospace Aircraft Group, Brough (England)

SECONDARY POWER SUPPLIES FOR A SMALL SINGLE ENGINE COMBAT AIRCRAFT

G JONES /n AGARD Auxiliary Power Systems 7 p Sep 1983

Avail NTIS HC A11/MF A01

A possible secondary power supply system for a small single engined combat aircraft is described along with the way in which reliability, survivability and installation problems influence the type

of system which is proposed for such an aircraft. The particular constraints imposed by the use of a Pegasus vectored thrust engine in a short take off vertical landing (STOVL) aircraft are also discussed. The proposed system consists of a conventional engine driven accessory gearbox to provide hydraulic and electrical power in flight. A remotely mounted auxiliary power unit (APU) is used to start the engine by means of a pneumatic link from a load compressor. The APU drives a separate standby hydraulic pump and generator for ground operation and emergency power in flight. Possible areas of future research and development which would lead to improved efficiency and reduced weight are also discussed

M G

N84-12176# Avions Marcel Dassault, Saint-Cloud (France). Dept au Bureau d'Etudes Sene

HYDRAULIC GENERATION OF AUXILIARY POWER FOR THE MIRAGE 2000 AIRCRAFT [GENERATION HYDRAULIQUE DE SECOURS DU MIRAGE 2000]

P ATLAN /n AGARD Auxiliary Power Systems 6 p Sep 1983 In FRENCH

Avail NTIS HC A11/MF A01

The auxiliary hydraulic power system of the Mirage 2000 aircraft is described and justified. The system was designed to respond to a particular problem that is specific to that aircraft. A source of energy was found and a means of putting it to work to assure the operation of the aircraft flight control hydraulic servocommand in the case of a dead engine and in the tail slide maneuver flight phase was developed

Transl by A R H

N84-12177# British Aerospace Aircraft Group, Preston (England)

OPTIMIZATION OF ENGINE POWER OFFTAKE BY SECONDARY POWER SYSTEM DESIGN

J R HOPKINS /n AGARD Auxiliary Power Systems 15 p Sep 1983 refs

Avail NTIS HC A11/MF A01

The configuration constraints presented to a systems engineer when designing a secondary power system are examined with particular reference to the minimizing of engine power offtake. The effects of power offtake on the engine and current solutions available to the systems designer are discussed. A secondary power system which is optimized for a twin engined, agile, combat aircraft is defined

M G

N84-12178# Rocket Research Corp, Redmond, Wash

HOT GAS APU STARTER FOR ADVANCED AIRCRAFT APPLICATIONS

B W SCHMITZ, L D GALBRAITH, W E JORGENSEN, and D A PAHL /n AGARD Auxiliary Power Systems 14 p Sep 1983 refs

(Contract F33615-76-C-2148)

Avail NTIS HC A11/MF A01

A hot gas rotary vane motor for aircraft APU starting over the environmental temperature range of -65 F to +130 F was tested. Problems with excessive gas consumption and binding of parts due to differential expansion are indicated. The effect of friction coefficient, vane weight, venting, and blade linking on overall internal friction are shown. Design approaches evolved to minimize overall friction and loads on the vanes. A motor successfully demonstrated operation at environmental temperatures down to -65 F and as repeated restart capability are solved. Design criteria allow application of the rotary vane motor to specific aircraft starting requirements

E A K

07 AIRCRAFT PROPULSION AND POWER

N84-12179# Teledyne CAE, Toledo, Ohio Advanced Development and Technical Planning
A JET FUEL STARTER FOR LOWEST SYSTEM LIFE CYCLE COST
R SMITH /n AGARD Auxiliary Power Systems 11 p Sep 1983 refs
(Contract F33657-76-C-2055)
Avail NTIS HC A11/MF A01

A modular Jet Fuel Starter design employing an Expendable Gasifier (EG) concept indicates a substantial life cycle cost savings over a conventional overhauled unit. To achieve these savings, a low cost gasifier is a mandatory requirement. The EG does this by maximizing cast to heat net shape components, using aluminum cold end castings and by minimizing the use of expensive high temperature alloys. Gasifier performance parameters, specific power, compressor pressure ratio, cycle temperature and fuel consumption, were selected to minimize component stress and sensitivity to refined dimensions. The gasifier interfaces were established to fit optional JFS and auxilarly power unit installations, and include turbojets and turbofans suitable for unmanned vehicles

E A K

N84-12180# Lufthansa G m b H, Hamburg (West Germany)
COST EFFICIENT ON BOARD POWER FOR AIRLINE OPERATION

K MOSE /n AGARD Auxiliary Power Systems 12 p Sep 1983

Avail NTIS HC A11/MF A01

Airline experience with auxiliary power units (APU), influenced by the fuel crisis was reviewed. Typical APU design features and performance outputs, supplying bleed air and/or electrical power on board the airplane are presented. It is suggested that the economical impact on APU operation are due to fuel cost increase and high level of APU maintenance cost. Remedy actions are proposed by incorporation of fuel saving modification programs and reduction of APU operating time which will effect the operating procedures. The utilization of alternative power sources on the ground, providing on board power, by mobile or stationary systems for electrical and pneumatic supply with respect to system compatibility with on board power requirements and availability and necessary cost investments are proposed

E A K

N84-12181# Messerschmitt-Boelkow-Blohm G m b H, Hamburg (West Germany)

APU OPERATIONAL EFFICIENCY

W HOOSE /n AGARD Auxiliary Power Systems 15 p Sep 1983

Avail NTIS HC A11/MF A01

Experience with a new generation on Auxiliary Power Unit (APU) installed in a commercial transport aircraft is presented. Operational requirements and efficiency of the APU in the Various operating modes are outlined. The factors determining the APU performance characteristics with respect to a cost effective are emphasized. Future development trends seen from the point of view of the aircraft manufacturer is considered

E A K

N84-12182# Vereinigte Flugtechnische Werke G m b H, Bremen (West Germany)

GROUND AND INFLIGHT OPERATIONAL EFFECTS OF APU'S
J H RENKEN /n AGARD Auxiliary Power Systems 17 p Sep 1983

Avail NTIS HC A11/MF A01

The Airbus APU which has a deliver well defined quantities of bleed air and electrical power under two very different conditions on ground and inflight was examined. The on ground operation is essentially governed by problems like noise generation and emission, and ingestion of hot gas, constraining the possible range of intake and exhaust position. The inflight operation is dominated by the external fuselage flow conditions intake and exhaust are exposed to and which may effect significantly the installation pressure-ratio and with that the inflight restart envelope and inflight performance. Depending on fuselage surface pressures and boundary layer conditions, intake and exhaust geometries and

ducting have to be designed so that a favourable IPR is provided during APU starting as well as APU operation, keeping at the same time negative effects on the aircraft as for instance drag increase at a minimum. The effect of these environmental conditions on the APU performance is discussed

E A K

N84-12183# Rocketdyne, Canoga Park, Calif
SUPER INTEGRATED POWER UNIT FOR FIGHTER AIRCRAFT
A D LUCCI, J A WILLIAMS, E C BEDER, and B L MCFADDEN (AFAPL, Wright-Patterson AFB, Ohio) /n AGARD Auxiliary Power Systems 6 p Sep 1983
Avail NTIS HC A11/MF A01

The SIPU concept the designs of the demonstrator, and each of its subsystems are described. An SIPU is a multifunctional aircraft power unit capable of providing (1) electrical, pneumatic, and hydraulic power for ground maintenance and standby operations, (2) normal and emergency main engine start power, and (3) emergency electrical and hydraulic power. Power is obtained either from jet fuel combustion with air for ground operations and normal engine starts, from a gas generator system using onboard stored propellants for emergency functions, or from the aircraft main engine compressor air for the emergency electrical and hydraulic power function. The benefits resulting from the use of an SIPU are presented

E A K

N84-12184# Rolls-Royce Ltd, Bristol (England)
ALL-ELECTRIC ACCESSORY DRIVE SYSTEMS: IMPLICATIONS ON ENGINE DESIGN AND PERFORMANCE

G B TOYNE and G S HODGES /n AGARD Auxiliary Power Systems 8 p Sep 1983
Avail NTIS HC A11/MF A01

All-electric accessory power systems were studied. The effects on engine design and performance are outlined. In the all-electric proposal, all accessory power requirements are generated and distributed electrically. Air bleeds for environmental control systems are replaced by increased shaft power offtake. The concept which is considered for a large subsonic offers the prospect of simplification and weight reduction in the engines. For supersonic combat aircraft, the concept is not recommended, with relatively higher levels of shaft power offtake, additional handing problems will be created. The effects on the engine and aircraft weight and systems as a whole consideration

E A K

N84-12185# Sundstrand Advanced Technology Group, Rockford, Ill
IMPLEMENTING MICROPROCESSOR TECHNOLOGY IN AIRCRAFT ELECTRICAL POWER GENERATING SYSTEM CONTROL
G RUFFNER, B MENL, and S LORENZ /n AGARD Auxiliary Power Systems 15 p Sep 1983 refs
Avail NTIS HC A11/MF A01

The implementation of microprocessor technology of most control protection, and build on test functions, the aircraft electrical power generating systems is described. The design implementation process used in current system is highlighted. With the adaptation of advanced microprocessor systems in the next generation of aircraft electric systems, additional functions can be implemented. Microprocessor control of generator paralleling and voltage regulation coupled with more effective built-in test capabilities will result in significant improvements in system performance

E A K

N84-12186# Auxilec S A, Colombus (France) Electro-Technics Dept
THE 400 HZ GENERATORS EVOLUTION, EFFECTS ON INSTALLATION ARRANGEMENTS

C JACQUES /n AGARD Auxiliary Power Systems 11 p Sep 1983
Avail NTIS HC A11/MF A01

The need for 400 Hz electric power which keeps on increasing on airplanes is discussed. Up to now the way to obtain constant frequency from variable speed drive is either hydro or electro mechanical. New conversion systems are arising they take benefits from the most recent improvements and developments in high

speed electrotechnics and power electronics Rotational speeds running at more than 2400 r p m are accessible to the onboard generator and a significant improvement of power to weight ratio is obtained The installation of such a generator on aircraft entails an high speed gear whic can be combined with it or, installed in the accessory gearbox The cooling of the whole system is realized by air or, by oil, electronic components included Optimum design leads to share the oil circuit of the gearbox with the generator cooling system

E A K

N84-12187 Wichita State Univ , Kans

ANALYTICAL DESIGN OF A LIQUID HYDROGEN FUELED TURBOFAN-RAMJET ENGINE FOR FLIGHT MACH NUMBERS ZERO TO FIVE Ph.D. Thesis

S SUWANPRASERT 1982 291 p

Avail Univ Microfilms Order No DA8308656

The analytical design of a hydrogen fueled, dual-cycle engine having either an annular "wraparound" turboramjet or side-by-side turbofan-ramjet has been conducted The typical flight profile was assumed with altitude ranging from sea level to 90,000 ft and Mach number from 0 to 5 The overall performances evaluated for both engines are presented in the form of the engine thrust, drag and thrust specific fuel consumption The corresponding weights and lengths of the engines are also determined The side-of-side turbofan-ramjet, which is lighter and shorter than the wraparound turboramjet, emerges as an optimum engine configuration It yields considerably higher overall performance over the entire prescnbed flight profile However, this optimum design requires a side-by-side combustion chamber for ramjet and turbofan afterburner with a variable position wall between the two chambers The optimum operating mode of the side-by-side turbofan-ramjet is then defined

Dissert Abstr.

N84-12188 California Univ , Berkeley

COMBUSTION JET IGNITION Ph.D. Thesis

D Y CHEN 1982 139 p

Avail Univ Microfilms Order No DA8312780

A combustion jet ignitor system was developed to generate turbulent jets of combustion products containing free radicals and to discharge them as ignition sources into a combustible medium In order to understand the ignition and the inflammation processes caused by combustion jets, the study of the fluid mechanical properties of turbulent jets with and without combustion were conducted theoretically and experimentally Experiments using a specially designed igniter, with a prechamber to build up and control the stagnation pressure upstream of the orifice, were conducted to investigate the formation processes of turbulent jets of combustion products The penetration speed of combustion jets has been found to be constant initially and then decreases monotonically as turbulent jets of combustion products travel closer to the wall This initial penetration speed of combustion jets is proportional to the initial stagnation pressure upstream of the orifice for the same stoichiometric mixture

Dissert Abstr.

N84-13186* Hamilton Standard, Windsor Locks, Conn

TECHNOLOGY AND BENEFITS OF AIRCRAFT COUNTER ROTATION PROPELLERS

A L WEISBRICH, J GODSTON (Pratt & Whitney Aircraft, East Hartford, Conn), and E BRADLEY (Lockheed-Georgia Co , Marietta) Dec 1982 330 p

(Contract NAS3-23043)

(NASA-CR-168258, NAS 1.26 168258, HSER-8856) Avail

Technical Monitor, NASA Lewis Research Center, Cleveland

CSCL 01A

Results are reported of a NASA sponsored analytical investigation into the ments of advanced counter rotation propellers for Mach 0 80 commercial transport application Propeller and gearbox performance, acoustics, vibration characteristics, weight, cost and maintenance requirements for a variety of design parameters and special features were considered Fuel savings in the neighborhood of 9 percent relative to single rotation configurations are feasible through swirl recovery and lighter gearboxes This is the net gain which includes a 5 percent acoustic

treatment weight penalty to offset the broader frequency spectrum of the noise produced by counter rotation propellers

Author

N84-13187*# Pennsylvania State Univ , University Park A THEORETICAL AND EXPERIMENTAL STUDY OF TURBULENT PARTICLE-LADEN JETS Annual Report

J S SHUEN, A S. P SOLOMON, Q F ZHANG, and G M FAETH Nov 1983 106 p refs

(Contract NAG3-190)

(NASA-CR-168293, NAS 1 26 168293) Avail NTIS HC A06/MF

A01 CSCL 21E

Mean and fluctuating velocities of both phases, particle mass fluxes, particle size distributions in turbulent particle-laden jets were measured The following models are considered (1) a locally homogeneous flow (LHF) model, where slip between the phases was neglected, (2) a deterministic separated flow (DSF) model, where slip was considered but effects of particle dispersion by turbulence were ignored, and (3) a stochastic separated flow (SSF) model. The SSF model performed reasonably well with no modifications in the prescriptions for eddy properties from its original calibration A modified k- model, incorporating direct contributions of interphase transport on turbulence properties (turbulence modulation), was developed within the framework of the SSF model

E A K

N84-13188*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio**FLAME RADIATION AND LINER HEAT TRANSFER IN A TUBULAR-CAN COMBUSTOR**

R W CLAUS, G M NEELY, and F M HUMENIK 1983 23 p refs Proposed for presentation at the 22nd Aerospace Sci Meeting, Reno, 9-12 Jan 1984, sponsored by AIAA

(NASA-TM-83538; E-1909, NAS 1 15 83538) Avail NTIS HC A02/MF A01 CSCL 21E

Heat transfer within a combustor were examined Total and spectral flame radiation in a tubular can combustor at a series of parametric operating conditions was measured Radiation measurements were taken for a range of inlet air pressures from 0 34 to 2 0 MPa, inlet air temperatures from 533 to 700 K, with two different fuels, Jet-A and ERBS Measurements of liner temperatures combined with the parametric radiation results allowed a calculation of the combustor liner heat loads Flame emissivity was determined from the spectral measurements

E A K

N84-13189*# California Univ , Berkeley**NUMERICAL MODELING OF TURBULENT FLOW IN A CHANNEL Final Report**

Y W DAI, A F GHONIEM, F S SHERMAN, and A K OPPENHEIM Mar 1983 68 p refs

(Contract NAG3-131, W-7405-ENG-48, NSF CPE-81-15163)

(NASA-CR-168278, DOE/NASA-0131/2, NAS 1 26 168278)

Avail NTIS HC A04/MF A01 CSCL 21E

Two-dimensional incompressible turbulent flow in a channel with a backward-facing step was studied numerically by Chorin's Random Vortex Method (RVM), an algorithn capable of tracing the action of elementary turbulent eddies and their cumulative effects without imposing any restrictions upon their motions The step occurs in one side of a channel with otherwise flat, parallel walls, its height equals 1/3, 1/4 or 1/5 the width of the channel downstream The main objective was to investigate the behavior of the large-scale turbulent eddies in a flow and the flow characteristics in the separated shear layer, the reattached zone, and the rebuilding boundary layer after reattachment The unsteady vorticity field and the distribution of time-averaged turbulent statistics were obtained The effects of expansion step height and initial boundary layer state were also studied Comparisons were made with the available experimental results The agreement is satisfactory in the velocity profiles and in the reattachment length, and fairly good in the turbulence profiles Also a mechanism of the development of the reattaching turbulent flow was suggested by the numerical results

Author

07 AIRCRAFT PROPULSION AND POWER

N84-13190*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
THREE-DIMENSIONAL VISCOUS DESIGN METHODOLOGY FOR ADVANCED TECHNOLOGY AIRCRAFT SUPERSONIC INLET SYSTEMS

B H ANDERSON Dec 1983 64 p refs Presented at the 21st Aerospace Sci Meeting, Reno, Nev, 9-12 Jan 1984 (NASA-TM-83558, E-1936, NAS 1 15 83558, AIAA-84-0192) Avail NTIS HC A04/MF A01 CSCL 21E

A broad program to develop advanced, reliable, and user oriented three-dimensional viscous design techniques for supersonic inlet systems, and encourage their transfer into the general user community is discussed. Features of the program include (1) develop effective methods of computing three-dimensional flows within a zonal modeling methodology, (2) ensure reasonable agreement between said analysis and selective sets of benchmark validation data, (3) develop user orientation into said analysis, and (4) explore and develop advanced numerical methodology Author

N84-13191*# Aeronautical Research Labs, Melbourne (Australia)

ENGINE PERFORMANCE MONITORING: ROLLS-ROYCE DART AND ALLISON T56 TURBO-PROP ENGINES

D E GLENNY Sep 1982 44 p refs (ARL-MECH-ENG-NOTE-393, AR-002-911) Avail NTIS HC A03/MF A01

Two Manual Inflight Engine Performance Monitoring Procedures for use on turboprop engines were devised. The first method, which involves relatively complex data reduction, is applicable in its present form only to the Rolls-Royce Dart engine. The second method, requiring only simple arithmetic calculations, may be used on any multi-engine aircraft. The basic principles and operating procedures for both methods are described. Analysis of inflight engine performance data for the Dart showed that even through consistent results in terms of performance trends can be produced, the computational equipment and procedures required to derive the appropriate trend graphics are excessive and are considered not to be warranted or cost-effective at present. With the second method, an analysis of trial data obtained from the Hercules C130-T56 aircraft has shown that effective engine performance monitoring trend plots, for both torque and fuel flow deviations, may be obtained. The simple data reduction procedures involved allow the relevant analyses to be carried out in flight by a flight engineer or suitable qualified person, thus giving immediate engine trend information for use by aircrew and maintenance personnel on a day-to-day basis Author

N84-13192*# Council for Scientific and Industrial Research, Pretoria (South Africa)

WORK DONE TO DETERMINE THE SOURCE OF ERRORS ON CONDITIONED PRESSURE TRANSDUCE SIGNALS IN THE JT9D-7F TURBOFAN ENGINES USED ON SAA BOEING 747 AIRCRAFT Progress Report

M GAFNER Oct 1982 25 p (NIAST-82/78, ISBN-0-7988-2606-1) Avail NTIS HC A02/MF A01

Details and results of tests completed to determine the influence of engine vibration on pressure transducers in the JT9D-7F engines used on Boeing 747 aircraft are presented. Recommendations for further investigation are made S L

N84-13193*# General Electric Co, Cincinnati, Ohio Aircraft Engine Business Group

BLADE LOSS TRANSIENT DYNAMICS ANALYSIS WITH FLEXIBLE BLADED DISK Final Report

V C GALLARDO, G BLACK, L BACH, S CLINE, and A STORACE Apr 1983 269 p refs (Contract NAS3-23281)

(NASA-CR-168176, NAS 1 26 168176) Avail NTIS HC A12/MF A01 CSCL 21E

The transient dynamic response of a flexible bladed disk on a flexible rotor in a two rotor system is formulated by modal synthesis

and a Lagrangian approach. Only the nonequilibrated one diameter flexible mode is considered for the flexible bladed disk, while the two flexible rotors are represented by their normal modes. The flexible bladed disk motion is modeled as a combination of two one diameter standing waves, and is coupled inertially and gyroscopically to the flexible rotors. Application to a two rotor model shows that a flexible bladed disk on one rotor can be driven into resonance by an unbalance in the other rotor, and at a frequency equal to the difference in the rotor speeds Author

N84-13194*# Lockheed Missiles and Space Co, Sunnyvale, Calif

A PRELIMINARY STUDY OF SOLAR POWERED AIRCRAFT AND ASSOCIATED POWER TRAINS Final Report

D W HALL, C D FORTENBACH, E V DIMICELI, and R W PARKS Dec 1983 205 p refs (Contract NAS1-16975)

(NASA-CR-3699, NAS 1 26 3699) Avail NTIS HC A10/MF A01 CSCL 21E

The feasibility of regeneratively powered solar high altitude powered platform (HAPP) remotely piloted vehicles was assessed. Those technologies which must be pursued to make long duration solar HAPPs feasible are recommended. A methodology which involved characterization and parametric analysis of roughly two dozen variables to determine vehicles capable of fulfilling the primary mission are defined. One of these vehicles was then conceptually designed. Variations of each major design parameter were investigated along with state-of-the-art changes in power train component capabilities. The midlatitude mission studied would be attainable by a solar HAPP if fuel cell, electrolyzer and photovoltaic technologies are pursued. Vehicles will be very large and have very lightweight structures in order to attain the combinations of altitude and duration required by the primary mission S C L

N84-13195*# Marquardt Corp, Van Nuys, Calif

PRELIMINARY SCRAMJET DESIGN FOR HYPERSONIC AIRBREATHING MISSILE APPLICATION Final Report

C H CARLSON Washington NASA Nov 1983 71 p refs (Contract NAS1-15434)

(NASA-CR-3742, NAS 1 26 3742, S-1585) Avail NTIS HC A04/MF A01 CSCL 21E

A conceptual design study of a scramjet engine was conducted for a hypersonic surface to air missile (HYSAM). The definition of the engine was based upon the requirements of accelerating the HYSAM from Mach 4 at 20,000 feet to Mach 6 at 100,000 feet and the cruise conditions at Mach 6. The resulting external and internal environmental conditions were used by various engineering disciplines performing design, stress and heat transfer analysis. A detailed structural analysis was conducted along with an in-depth thermal analysis. Structurally all the components within the system exhibit positive margins of safety. A feasible concept was defined which uses state-of-the-art materials and existing TMC technology. The engine basically consists of a three dimensional carbon/carbon combustor/nozzle secured to an FS-85 columbium inlet. The carbon/carbon liner is sheathed with carbon felt insulation to thermally protect the FS-85 structure and skin. The thermal analysis of the engine indicates that a thermally viable configuration exists Author

N84-13196*# Army Materials and Mechanics Research Center, Watertown, Mass

CHARACTERIZATION OF CERAMIC VANE MATERIALS FOR 10KW TURBOALTERNATOR Final Report

G D QUINN, D R MESSIER, and L J SCHIOLER Apr 1983 32 p

(Contract DA PROJ 1L7-63702-DG-11) (AD-A132505, AMMRC-TR-83-18) Avail NTIS HCA03/MFA01 CSCL 21E

Characterization was done on four vane candidate materials: hot pressed silicon nitride, sintered silicon nitride, sintered silicon carbide, and siliconized silicon carbide, being considered for use in a small turbine engine. Chemistry, phase content, and room

temperature mechanical strength were in the ranges expected for such materials. Fracture locations and origins were identified whenever possible, and measurements of fracture mirror radii and flaw sizes were done to enable fracture mechanics parameters to be calculated. Oxidation resistance of all materials was excellent at 950 to 1100 C. High temperature (800 to 1200 C) mechanical behavior was characterized via stepped temperature stress rupture and conventional stress rupture testing. A possible instability was found in the sintered silicon nitride at 1000 C. The hot pressed silicon nitride was subject to static fatigue at temperatures from 800 to 1100 C. The two silicon carbide materials performed adequately over the same temperature range

GRA

08

AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities, piloting, flight controls, and autopilots

A84-13380#

A-10 DCAS PROVEN THROUGH REALISTIC SIMULATION

G BRANDAU and W SHAWLER (Fairchild Republic Co., Farmingdale, NY) AIAA, AHS, IES, SETP, SFTE, and DGLR, Flight Testing Conference, 2nd, Las Vegas, NV, Nov 16-18, 1983 7 p

(AIAA PAPER 83-2721)

The A-10 aircraft has been designed for close air support missions. Since the original design of the aircraft, the tactics used for implementing this mission have changed considerably, and improvements related to flight control are needed for the execution of maneuvers at very low altitude. The Digital Command Augmentation System (DCAS) was designed to provide these improvements. Details concerning the DCAS Longitudinal Control System and the DCAS Lateral-Directional Control System are discussed, and a description is presented of the simulator which was employed to evaluate the merits of the DCAS

MSK

A84-13391#

PRELIMINARY DESIGN OF A DIGITAL COMMAND AUGMENTATION SYSTEM FOR THE A-10 AIRCRAFT

G BRANDAU (Fairchild Republic Co., Farmingdale, NY) and F DECANIO (Charles Stark Draper Laboratory, Inc., Cambridge, MA) American Institute of Aeronautics and Astronautics, Aircraft Design, Systems and Technology Meeting, Fort Worth, TX, Oct 17-19, 1983 17 p

(AIAA PAPER 83-2490)

It is pointed out that the A-10 aircraft uses presently a mechanical flight-control system together with an analog stability augmentation system (SAS) which provides pitch rate and dutch roll damping as well as turn coordination. In connection with the development of progressively more aggressive, very low-altitude maneuvers, this system has been modified. The mission characteristics are considered along with the derived requirements, a fault-tolerant mechanization, the existing mechanical flight controls, and the existing stability augmentation system. A description of the proposed flight control system is provided, taking into account the longitudinal control system, longitudinal pilot relief modes, and the lateral-directional control system. Attention is also given to a piloted simulation evaluation, aspects of system mechanization, maintainability, and the redundancy management system

GR

A84-13398#

FLUIDICS - A RELIABLE ALTERNATIVE FOR AIRCRAFT CONTROL

R L BENOIT and J B LEONARD (Grumman Aerospace Corp., Bethpage, NY) Mechanical Engineering (ISSN 0025-6501), vol 105, Nov 1983, p 30-39

The benefits and characteristics of fluidic backup control systems for military aircraft that have fly-by-wire controls are described. Fluidics supplies sensing, computing, and controlling functions through the interaction of fluid streams composed of fluid, air, etc. The signal between the cockpit control and the control surface actuators is transmitted by means of the fluidic flight control system (FCS). Only fly-by-wire and fluidic control systems are suitable for modern, high performance military aircraft, and fluidics systems have the added advantage of being impervious to EMP/EMI disturbances, the fluidics systems are not, however, as high performance nor are the computational capabilities as great as with electronic systems. The control is achieved through differential pressures through the channels of the fluidics system, which is amenable to providing feedback for actuator positions. It is expected that a two-channel fly-by-wire system with a fluidic backup will be ready for use by 1985-90, and will weigh only 766 lb

MSK

A84-14728#

CONTROL OF AEROELASTIC DIVERGENCE

R R CHIPMAN, A M ZISLIN, and C WATERS (Grumman Aerospace Corp., Bethpage, NY) (Structures, Structural Dynamics and Materials Conference, 23rd, New Orleans, LA, May 10-12, 1982, Collection of Technical Papers Part 2, p 209-219) Journal of Aircraft (ISSN 0021-8669), vol 20, Dec 1983, p 1007-1013 refs

Previously cited in issue 13, p 2023, Accession no A82-30151

A84-15193

TORNADO AUTOPILOT MEASURES TO ENSURE SURVIVABILITY AFTER FAILURES

W SCHMIDT and U BUTTER (Messerschmitt-Boelkow-Blohm GmbH, Munich, West Germany) NATO, AGARD, Symposium on Flight Mechanics and System Design Lessons from Operational Experience, Athens, Greece, May 10-14, 1983, Paper 10 p (MBB-FE-325/PUB/TOR/007)

Measures applied to the autopilot of the TORNADO to ensure survivability of the aircraft after failures during automatic low level flying are presented. Apart from redundant equipment, these measures include hardware and software limiters to minimize the effect of failures upon the aircraft, hardware and software monitors to detect and isolate failures, emergency procedures to initiate recovery manoeuvres, as well as efficient testing of software

Author

A84-15195#

SOFTWARE TESTING OF SAFETY CRITICAL SYSTEMS

J STOCKER (Messerschmitt-Boelkow-Blohm GmbH, Munich, West Germany) NATO, AGARD, Symposium on Advanced Concepts for Avionics and Weapon System Design, Development, and Integration, Ottawa, Canada, Apr 18-22, 1983, Paper 10 p refs (MBB-FE-352/S/PUB/106)

Procedures employed to test the software for the Tornado fighter Autopilot and Flight Director System (AFDS) are outlined, including details of the test facility. The AFDS features duplex redundancy, with failure in either of the two computers resulting in shut down and switch over. Fault avoidance measures are taken in writing the software, combined with dynamic analytical fault and static analytical fault avoidance efforts, which are extended to comprise fault tolerance. Bench tests are run for acceptance in closed loop modes. Flight tests are performed when a sufficient degree of confidence is gained. A cross software test system (CSTS) provides computerized coupling and testing of the behavior of the software installed in the Tornado AFDS, which is flown on the ground by a test pilot to examine the performance in real

08 AIRCRAFT STABILITY AND CONTROL

time Only deviations from predicted values are stored in the test output data M S K

A84-15252#

THE STABILITY BOUNDARIES OF RAPID-ROLLING AIRCRAFT WITH FUSELAGE ELASTICITY CONSIDERED

Z HE (Northwestern Polytechnical University, People's Republic of China) *Acta Aerodynamica Sinica*, no 3, 1983, p 30-37 In Chinese, With abstract in English refs

Computational results are presented which show that elastic bending deformations of the fuselage appreciably affect the stability of rapidly rolling aircraft Eighth-order differential equations are derived from Lagrange's equations and are presented in matrix forms The characteristic equation of these differential equations is also of eighth degree The analytical solution of the differential equations cannot generally be found, so detailed analysis and numerical computations are used to obtain the first instability root of the characteristic equation, which is generally real and corresponds to nonperiodic motion, when the root equals zero it corresponds to the critical value of the roll rate Analytical expressions for the roots of the characteristic equation are presented which can be regarded as extensions of the Phillips criteria when the effect of fuselage elasticity is included C D

A84-15652

AVIONIC ARCHITECTURES FOR FLY-BY-WIRE AIRCRAFT

G M PAPADOPOULOS (Honeywell Systems and Research Center, Minneapolis, MN) IN *NTC '82*, National Telesystems Conference, Galveston, TX, November 7-10, 1982, Conference Record New York, Institute of Electrical and Electronics Engineers, Inc, 1982, p B5 5 1-B5 5 3

Advances in flight control, airframe, engine, communication, and instrumentation have led to increases in complexity Modern designs are characterized by isolated, independently designed subsystems It has been found that reliability is degraded as complexity is increased and that the full performance potential of the system is not realized For an achievement of higher performance, a system should be so structured as to allow the free flow of information from one subsystem or function to another without endangering the reliable operation of either Attention is given to safety of flight reliability, flight control architectures, the Multiple Microprocessor Flight Control System Study (MMFCS), and the generalization of MMFCS concepts to the rest of the avionics system G R

N84-12035# National Aeronautics and Space Administration Langley Research Center, Hampton, Va

GENERAL AVIATION SINGLE PILOT IFR AUTOPILOT STUDY

H P BERGERON *In its Controls, Displays and Inform Transfer for Gen Aviation IFR Operations* p 85-96 Oct 1983 refs Avail NTIS HC A12/MF A01 CSCL 01C

Five levels of autopilot complexity were flown in a single engine IFR simulation for several different IFR terminal operations A comparison was made of the five levels of complexity ranging from no autopilot to a fully coupled lateral and vertical guidance mode to determine the relative benefits versus complexity/cost of state-of-the-art autopilot capability in the IFR terminal area Of the five levels tested, the heading select mode made the largest relative difference in decreasing workload and simplifying the approach task It was also found that the largest number of blunders was detected with the most highly automated mode The data also showed that, regardless of the autopilot mode, performance during an IFR approach was highly dependent on the type of approach being flown These results indicate that automation can be useful when making IFR approaches in a high workload environment, but also that some disturbing trends are associated with some of the higher levels of automation found in state-of-the-art autopilots Author

N84-12036# National Aeronautics and Space Administration Langley Research Center, Hampton, Va

FLIGHT TEST VALIDATION OF A DESIGN PROCEDURE FOR DIGITAL AUTOPILOTS

W H BRYANT *In its Controls, Displays and Inform Transfer for Gen Aviation IFR Operations* p 97-110 Oct 1983 refs Avail NTIS HC A12/MF A01 CSCL 01C

Commercially available general aviation autopilots are currently in transition from an analogue circuit system to a computer implemented digital flight control system Well known advantages of the digital autopilot include enhanced modes, self-test capacity, fault detection, and greater computational capacity A digital autopilot's computational capacity can be used to full advantage by increasing the sophistication of the digital autopilot's chief function, stability and control NASA's Langley Research Center has been pursuing the development of direct digital design tools for aircraft stabilization systems for several years This effort has most recently been directed towards the development and realization of multi-mode digital autopilots for GA aircraft, conducted under a SPIFR-related program called the General Aviation Terminal Operations Research (GATOR) Program This presentation focuses on the implementation and testing of a candidate multi-mode autopilot designed using these newly developed tools Author

N84-12038# Kansas Univ, Lawrence

PILOT CONTROLS AND SPIRF FLIGHT

D R DOWNING *In NASA Langley Research Center Controls, Displays and Inform Transfer for Gen Aviation IFR Operations* p 121-140 Oct 1983 refs

Avail NTIS HC A12/MF A01 CSCL 01C

A study was performed to determine the relative advantages and disadvantages of four candidate pilot control devices for use by a single pilot flying a general aviation aircraft in instrument meteorological conditions Only the pitch and roll axes were considered The control devices examined were the wheel-yoke, center-stick, Broiley handles, and side-arm controller Qualitative evaluation criteria were established that included instrument panel visibility, control sensitivity, pilot comfort, and space requirement behind the instrument panel The results of the study indicated that the side-arm controller offered the possibility of an improvement, but further research was necessary to determine its feasibility Author

N84-12061# Northrop Corp, Hawthorne, Calif Aircraft Div

APPLICATION OF FLIGHT CONTROLS TECHNOLOGY TO ENGINE CONTROL SYSTEMS

R J SEEMANN and J L LOCKENOUR *In AGARD Integration of Fire Control, Flight Control and Propulsion Control Systems* 26 p Aug 1983 refs

Avail NTIS HC A09/MF A01

A system design approach is outlined and some considerations for the design of electronically implemented control laws are discussed A typical redundancy management concept, based on digital flight control techniques, for a quadruplex engine control system is described This is followed by an analysis methodology to determine the probability of control system failure Some implications that the use of probability theory has on the control system design requirements are discussed M G

N84-12062# Societe Nationale d'Etudes et de Construction de Moteurs d'Aviation, Moissy-Cramayel (France)

THE RELATIONS BETWEEN THE NUMERICAL CONTROL OF THE ENGINE AND OTHER AIRCRAFT FUNCTIONS [LIENS ENTRE LA REGULATION NUMERIQUE DU MOTEUR ET LES AUTRES FONCTIONS DE L'AVION]

D RAMBACH *In AGARD Integration of Fire Control, Flight Control and Propulsion Control Systems* 9 p Aug 1983 In FRENCH

Avail NTIS HC A09/MF A01

Numerical control opens the door to a larger integration of the aircraft engine by means of dialog with the pilot and other aircraft systems, either to provide new functions or to improve actual

08 AIRCRAFT STABILITY AND CONTROL

services The objectives aimed for cover better performance, a nontotal optimization, and a greater ease in piloting. To accomplish this, several systems must dialog A number of structures permit this A method is proposed for choosing a structure that preserves to each important system its autonomy in case of difficulty while always benefitting from the advantage of integration The functions are analyzed and regrouped in a pyramid so as to respect a nonpropagation of engine trouble The objective is to preserve a distinct and controllable organization in the integrated system. This nonoptimal organization gives priority to reliability on the one hand, and an unambiguous division of responsibilities on the other

ARH

N84-12069# Bodenseewerk Geraetetechnik G.m b H., Ueberlingen (West Germany)

AN INTEGRATED AFCS FOR THE "PROFILE"-MODE

P. WUEST and W. ALLES /n AGARD Integration of Fire Control, Flight Control and Propulsion Control Systems 11 p Aug. 1983 refs

Avail NTIS HC A09/MF A01

The structure of the integrated control system and the appropriate parameter design method using the AIRBUS A300 as an example is described The structure of the system is characterized by (1) a mixture of feedforward and feedback control thus allowing to separate the design of the command disturbance characteristics, and (2) decoupling speed and height loop The control system design relies on the knowledge of aircraft and engine characteristics, both known to the FMC or similar devices To ease the analytic parameter design, the relevant aircraft dynamic is simplified by the incorporation of well proven basic loops such as pitch attitude feedback and N1/EPR-control Within the scope of this simplification eigenvalues of the entire system are prescribed Energy-saving aspects by the reduction of throttle lever excursions is considered using this approach

EAK

N84-12070# British Aerospace Aircraft Group, Brough (England) ACT Design Group

THE INTEGRATION OF FLIGHT AND ENGINE CONTROL FOR VSTOL AIRCRAFT

N P PATTINSON /n AGARD Integration of Fire Control, Flight Control and Propulsion Control Systems 7 p Aug 1983 refs

Avail NTIS HC A09/MF A01

A control philosophy appropriate to future jet VSTOL aircraft which leads naturally to the integration of flight and engine control system is discussed The potential benefits of this class of system are stated and integration aspects, both in terms of control laws and at the hardware level, are considered The areas surrounding this approach to VSTOL control which require deeper study are outlined

EAK

N84-12071# Office National d'Etudes et de Recherches Aerospatiales, Paris (France)

A NONLINEAR CONTROL LAW FOR PILOTING AIRCRAFT IN THE AIR-TO-GROUND ATTACK PHASE [SUR UNE LOI DE COMMANDE NON-LINEAIRE POUR LE PILOTAGE DES AVIONS EN PHASE D'ATTAQUE AIR-SOL]

B D VU and O L MERCIER /n AGARD Integration of Fire Control, Flight Control and Propulsion Control Systems 10 p Aug 1983 refs In FRENCH, ENGLISH summary

Avail NTIS HC A09/MF A01

With focus on the control configured vehicle concept, a manual and non-conventional aircraft control law is presented which provides an improved target tracking in air-to-ground gunnery The system architecture which integrates a weapon system, a fire control system and a flight control system is analyzed In comparison to classical flight control systems, improvements come mainly from the elaborate processing of the pilot steering commands The application of modern nonlinear control techniques to the design of the control law makes it otherwise well-suited for aircraft alignment maneuvers of large magnitude The controllability of a linear version of the control law was demonstrated on a manned simulator

Author

N84-12189 Kansas Univ, Lawrence

A FAULT-TOLERANT DISTRIBUTED COMPUTER NETWORK DESIGN AND ANALYSIS FOR AN INTEGRATED FLIGHT CONTROL SYSTEM Ph.D. Thesis

D P W JIANG 1982 262 p

Avail Univ Microfilms Order No. DA8309353

A Fault-Tolerant Distributed Computer (FTDC) Network for an integrated flight control system was designed for real time control applications requiring good reliability, availability, and survivability characteristics A Maximally Connect Minimum Diameter topology with node connection degree 4 (MCMD-4) is proposed which minimized the average message time delay Realization MCMD-4 graphs with diameter 2 and 3 are given A comparison of graph diameter and fault tolerant capability of MCMD-4 graphs with other topologies is included Network reliability bounds were obtained which included four paths between any two nodes for MCMD-4 networks and Harary-Hakimi networks Network hardware design for a seven node network was completed and tested Each node was designed with a node connection degree of four where the communication processor handled data at 2 MBPS on each of the four channels into a node and on each of the four channels out of a node for a total node capacity of 16 MBPS

Dissert Abstr

N84-12190*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va

SIMULATOR STUDY OF FLIGHT CHARACTERISTICS OF A LARGE TWIN-FUSELAGE CARGO TRANSPORT AIRPLANE DURING APPROACH AND LANDING

W D GRANTHAM, P L DEAL, G L KEYSER, JR., and P M SMITH (Kenton International, Inc) Nov 1983 87 p refs (NASA-TP-2183, L-15505, NAS 1 60 2183) Avail NTIS HC A05/MF A01 CSCL 01C

A six degree-of-freedom, ground-based simulator study was conducted to evaluate the low speed flight characteristics of a twin fuselage cargo transport airplane and to compare these characteristics with those of a large, single fuselage (reference) transport configuration which was similar to the Lockheed C-5C airplane The primary piloting task was the approach and landing The results indicated that in order to achieve 'acceptable' low speed handling qualities on the twin fuselage concept, considerable stability and control augmentation was required, and although the augmented airplane could be landed safely under adverse conditions, the roll performance of the aircraft had to be improved appreciably before the handling qualities were rated as being 'satisfactory' These ground-based simulation results indicated that a value of $t_{sub \phi} = 30$ (time required to bank 30 deg) less than 6 sec should result in 'acceptable' roll response characteristics, and when $t_{sub \phi} = 30$ is less than 3.8 sec, 'satisfactory' roll response should be attainable on such large and unusually configured aircraft as the subject twin fuselage cargo transport concept

SL

N84-12191# Air Force Wright Aeronautical Labs, Wright-Patterson AFB, Ohio Aeroelastic Group

DEVELOPMENT AND FLIGHT TEST OF AN ACTIVE FLUTTER SUPPRESSION SYSTEM FOR THE F-4F WITH STORES. PART 3. FLIGHT DEMONSTRATION OF THE ACTIVE FLUTTER SUPPRESSION SYSTEM Final Report, Mar. - Dec. 1980

H HOENLINGER, D MUSSMAN, R MANSER, and L J HUTTSELL Jun 1983 66 p Prepared in cooperation with Messerschmitt-Blohm-Blohm GmbH, Ottobrunn (West Germany) (Contract AF PROJ 2401)

(AD-A131972, AFWAL-TR-82-3040-PT-3) Avail NTIS HCA04/MFA01 CSCL 01C

A flutter suppression system was developed and flight tested on an F-4F aircraft The control law was designed by MBB (Messerschmitt-Bolkow-Blohm GmbH) using optimal control theory to minimize the control surface motion and to provide the required stability margins During the test it was found that the dynamic behavior of the wing-pylon-store changed considerably with excitation amplitude due to free play and preload The active flutter

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suppression system worked well and provided an increase in flutter speed
GRA

N84-13197*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

FLIGHT TEST AND ANALYSES OF THE B-1 STRUCTURAL MODE CONTROL SYSTEM AT SUPERSONIC FLIGHT CONDITIONS Final Report

J H WYKES, M J KELPL, and M J BROSNAH Dec 1983

108 p refs

(Contract NAS4-2932)

(NASA-CR-170405, NAS 1 26 170405) Avail NTIS HC A06/MF A01 CSCL 01C

A practical structural mode control system (SMCS) that could be turned on at takeoff and be left on for the entire flight was demonstrated. The SMCS appears to be more effective in damping the key fuselage bending modes at supersonic speeds than at the design point of Mach 0.85 (for fixed gains). The SMCS has an adverse effect on high frequency symmetric modes, however, this adverse effect did not make the system unstable and does not appear to affect ride quality performance. The vertical ride quality analyses indicate that the basic configuration without active systems is satisfactory for long term exposure. If clear air turbulence were to be encountered, indications are that the SMCS would be very effective in reducing the adverse accelerations. On the other hand, lateral ride quality analyses indicate that the aircraft with the SMCS on does not quite meet the long term exposure criteria, but would be satisfactory for short term exposure at altitude. Again, the lateral SMCS was shown to be very effective in reducing peak lateral accelerations

SCL

N84-13198*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

FLIGHT-TEST OF THE GLIDE-SLOPE TRACK AND FLARE-CONTROL LAWS FOR AN AUTOMATIC LANDING SYSTEM FOR A POWERED-LIFT STOL AIRPLANE

D M WATSON, G H HARDY, and D N WARNER, JR Dec 1983 89 p refs

(NASA-TP-2128, A-9199, NAS 1 60 2128) Avail NTIS HC A05/MF A01 CSCL 01C

An automatic landing system was developed for the Augmentor Wing Jet STOL Research Airplane to establish the feasibility and examine the operating characteristics of a powered-lift STOL transport flying a steep, microwave landing system (MLS) glide slope to automatically land on a STOL port. The flight test results address the longitudinal aspects of automatic powered lift STOL airplane operation including glide slope tracking on the backside of the power curve, flare, and touchdown. Three different autoland control laws were evaluated to demonstrate the tradeoff between control complexity and the resulting performance. The flight test and simulation methodology used in developing conventional jet transport systems was applied to the powered-lift STOL airplane. The results obtained suggest that an automatic landing system for a powered-lift STOL airplane operating into an MLS-equipped STOL port is feasible. However, the airplane must be provided with a means of rapidly regulation lift to satisfactorily provide the glide slope tracking and control of touchdown sink rate needed for automatic landings

SL

N84-13199*# Naval Postgraduate School, Monterey, Calif

A MICROCOMPUTER PROGRAM PACKAGE OF THE USAF STABILITY AND CONTROL DATCOM M.S. Thesis

J R MCGOWAN Jun 1983 38 p

(AD-A132143, AD-E850405) Avail NTIS HCA03/MFA01

CSCL 09B

A microcomputer application program package utilizing the methodology of the USAF STABILITY AND CONTROL DATCOM has been implemented to estimate aircraft stability and control derivatives. The program package is designed for use on personal computer systems which utilize the BASIC programming language

GRA

09

RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways, aircraft repair and overhaul facilities, wind tunnels, shock tube facilities, and engine test blocks

A84-13399*#

CAT FOR GROUND VIBRATION TESTING

J LONG and T DAVIS Mechanical Engineering (ISSN 0025-6501), vol 105, Nov 1983, p 40-42

The implementation of small computer-aided test systems (CAT) for testing airframes in-the-field is described. Attention is focused on a CAT for vibration testing of the Lear Fanjet. The CAT is capable of testing the soundness of the airframe to a degree that is acceptable for FAA certification before flight testing. It can also be applied to examine the propulsion and landing systems mechanical integrity. The use of random vibration testing furthermore eliminates the long time required with the sine dwell technique that is the current standard. The randomness of the signal inputs all frequencies into the structure, instead of only pure tones, and thus reveals problems that would occur in actual use of the machines when operation causes interactive vibrations. Seven weeks of tests can now be telescoped into one day

M S K.

A84-13572*#

REVIEW OF SUPPORT INTERFERENCE IN DYNAMIC TESTS

L E ERICSSON and J P REDING (Lockheed Missiles and Space Co, Inc, Sunnyvale, CA) AIAA Journal (ISSN 0001-1452), vol. 21, Dec 1983, p 1652-1666 refs

Previously cited in issue 10, p 1553, Accession no A82-24668

A84-13573*#

WIND TUNNEL WALL CORRECTIONS DEDUCED BY ITERATING FROM MEASURED WALL STATIC PRESSURE

D F MOSES (San Diego State University, San Diego, CA) AIAA Journal (ISSN 0001-1452), vol 21, Dec 1983, p 1667-1673 refs

An iterative method for calculating wall interference corrections to model lift and induced drag from simple flowfield measurements is presented. The method is applied to low-speed solid-wall wind tunnels, where the only measurements required are wall static pressures. The procedure for the iterations is described and the criterion for convergence to unconfined flow is given. The advantages of this method are that it easily handles cases having strong viscous effects, models with running propellers, etc. The viability of the procedure is demonstrated in a low-speed wind tunnel test of a wing model. A comparison shows that the standard method of images undercorrects, in this particular case, by about 20-30 percent

Author

A84-13631*#

A NEW BENCH FOR CALIBRATION OF NACELLES EQUIPPED FOR BLOWING TURBINES (TPS) AND EJECTOR TRIALS [NOUVEAU BANC D'ETALONNAGE DE NACELLES EQUIPEES DE TURBINES POUR SOUFFLANTES (TPS), ET ESSAIS D'EJECTEURS]

J P BECLE, J COSTE, and J LEYNAERT (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) (NATO, AGARD, Symposium on Wind Tunnels and Testing Techniques, Cesme, Turkey, Sept 26-30, 1983) ONERA, TP, no 1983-118, 1983, 13 p In French refs

(ONERA, TP NO 1983-118)

The calibration bench for the turbopowered simulator (TPS) used with models in the S1MA and F1 ONERA wind tunnels is characterized in terms of equipment and functions. Two compressed air supply devices are provided, together with the wind tunnel wall balance and depressurized tank casing. The TPS, when acting as an ejector, depressurizes the tank. The assembly

09 RESEARCH AND SUPPORT FACILITIES (AIR)

permits wind tunnel simulations of flights at different altitudes. Data are presented on trials with different ejector nozzles, and consideration is devoted to stable and unstable flow conditions

M S K

A84-13643#

NEW DEVICE FOR FLOW SURVEY AROUND MODELS IN LARGE WIND-TUNNELS

P BROUSSAUD (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) (Supersonic Tunnel Association, Semi-Annual Meeting, 60th, Williamsburg, VA, Oct. 6, 7, 1983) ONERA, TP, no 1983-128, 1983, 18 p refs (ONERA, TP NO. 1983-128)

Design and performance characteristics of a probe device devised by ONERA to analyze the flow around large models in subsonic and pressurized wind tunnel trials are described. Specifications included compatibility with sting-mounted tests of general aviation aircraft with wing spans up to 3 m and military aircraft models with wing spans up to 3.5 m, rigidity sufficient to perform at high angles of attack, manual or computer controlled steering capability, and ability to carry a variety of normal wind tunnel probes. Volumes were set for three-axis measurements. A motorized configuration on a jointed arm was selected, together with both fixed and moveable probes. Tests in the S1 and M1 wind tunnels demonstrated that the device could support a probe for sweeping planes, surface sweeps, and for plotting streamlines. The successful measurements have been made of the wing canard cortex interaction, the wake on complete models, the flow at a high angle of attack around an ogive-cylindrical body, and in tests of a half-model at the wall

M S K

A84-15402

PLANNING AND DESIGN OF AIRPORTS /3RD EDITION/

R HORONJEFF and F X MCKELVEY (Michigan State University, East Lansing, MI) New York, McGraw-Hill Book Co., 1983, 630 p refs

Airport planning and design are discussed in light of the most up-to-date principles, standards, and techniques. The topics addressed include the nature of civil aviation, airport financing, aircraft characteristics related to airport design, air traffic control, airport planning, forecasting in aviation and airport planning, airport configuration, airport airside capacity and delay. Also considered are geometric design of the landing area, planning and design of the terminal area, design of heliports and STOL ports, structural design of airport pavements, lighting, marking, and signing, airport drainage, environmental and economic assessment of projects

C D

A84-15421#

FUNCTIONAL AIRPORT INSTALLATIONS - A NECESSARY CONDITION FOR AVIATION TODAY AND TOMORROW [FUNKTIONSGERECHTE FLUGPLATZANLAGEN - VORAUSSETZUNG FUER DIE LUFTFAHRT HEUTE UND MORGEN]

K SIEBENWURST (Arbeitsgemeinschaft Deutscher Verkehrsflughäfen, Stuttgart, West Germany) IN. Problems and development trends in general aviation; Symposium, Friedrichshafen, West Germany, March 24, 25, 1983, Reports Bonn, Deutsche Gesellschaft für Luft- und Raumfahrt, 1983, p 325-335 In German

The ability of an airport for performing the assigned functions is an important factor for the efficient execution of air traffic operations. In order to establish airports which are well suited for the performance of their functions, it is necessary to take into consideration a number of complex relations. The performance of the daily operations on the airport requires experience and detailed knowledge regarding the involved aspects. Certain basic considerations have to be taken into account in the establishment and operation of airports which function with optimum efficiency. A description is presented of the airport system in West Germany, taking into account important economic relations, and initiatives provided by the airports for aviation

G R

A84-15859#

EXCITATION SYSTEM FOR WIND-TUNNEL UNSTEADY TESTS ON HALF-WING MODELS

R DESTUYNDER La Recherche Aerospaciale (English Edition) (ISSN 0379-380X), no 3, 1983, p 71, 72

The design and operation of a system developed to excite a half-wing wind-tunnel model through its root without significantly altering its dynamic structure are reported. The setup includes a hydraulic actuator operating in wide-band-white-noise, frequency-sweep, or fixed-frequency mode, a tube under pure torsion to transmit torque (of about 2,400 Nm), and a flexible coupling which isolates the model from the actuator in the bending mode. Sample test results are presented in a table and graph, and a drawing of the setup is provided. The device produces no significant perturbations of eigenmode shape or frequency and can also be used as a servo-type safety system for flutter tests

D G

N84-12149# Office of Technology Assessment, Washington, D C

AIRPORT CAPACITY ALTERNATIVES

In its Airport and Air Traffic Control System p 101-122 Jan 1982 refs

Avail SOD HC \$6 00 as 052-003-00873-4

The airport components in the operation of a typical airport are described. The major factors which influence or limit airside capacity are reviewed. The problem of delay, alternate methods for reducing delay or increasing the airside capacity is discussed. These include changing the pattern of traffic demand, expanding the runway system, or modifying the terminal area air traffic control procedures and equipment

Author

N84-12195# BDM Corp, McLean, Va

RAPID RUNWAY REPAIR PROGRAM SUBTASK 1.07 - RAPID CONCRETE CUTTING Final Technical Report, Mar. 1982 - Jan. 1983

R K MOATS, F D WANG, W DEARS (Air Force Engineering and Services Center, Tyndall AFB, Fla.), and G G YIE (Fluidyne Corp., Auburn, Wash.) Tyndall AFB, Fla. Air Force Engineering and Services Center Jun 1983 197 p (Contract F08635-80-C-0206, AF PROJ 2673) (AD-A131771, BDM/W-82-770-TR, AFESC/ESL-TR-83-09) Avail NTIS HCA09/MFA01 CSCL 13B

Two concrete-cutting technologies utilizing high-pressure waterjets have been investigated to assess their feasibility in achieving rapid cutting rates (30 sq ft/min) to facilitate bomb damage repair to runways. The current cutting rate of abrasive waterjets was established as 0.25 sq ft/min for a 60 hp system. Present scaling information indicates that for the near term the technology cannot feasibly achieve the desired cutting rate without a major technical breakthrough. Data from laboratory tests of linear cutting with a single carbide pick assisted with a waterjet indicate that high cutting rates are feasible with that technology. The waterjet-assisted mechanical cutting technology, however, has not been developed as a concrete cutting system. Prototype concepts are proposed in this report and an estimate is made of the power requirement to achieve the desired cutting rate (250 hp to cut 30 sq ft/min)

GRA

N84-13200# National Aerospace Lab., Tokyo (Japan)

A NEW OPERATION METHOD FOR A LARGE-SCALE SHOCK TUNNEL

K SOGA, Y INOUE, and T YAMAZAKI 1983 14 p refs In JAPANESE, ENGLISH summary (NAL-TR-765, ISSN-0389-4010) Avail NTIS HC A02/MF A01

In order to construct and operate a large-scale shock tunnel for use in such projects as the recovery of rocket payloads and artificial satellites, a new operational method for short-duration wind tunnels using a large-orifice plate and high speed valves is proposed. The practicability of this method was studied using the gun tunnel, and the results of these experiments are shown. The measurements of the tunnel stagnation pressure and temperature changing the orifice area with and without a piston, performance

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test of the high speed valve installed in front of the nozzle, and measurements of pitot pressure and stagnation heat-transfer rate of the cylinder to diagnose the flow established in the test section are provided. The results of the preliminary experiment operation of a large-scale short duration wind tunnel. The exclusion of the diaphragms and the piston enabled us not only to make a large-scale wind tunnel but also to eliminate dust in the flow. By using a large-orifice plate together with high speed valves, early stabilization of tunnel stagnation conductances and a steady flow in the test section were achieved. Author

N84-13201# Naval Postgraduate School, Monterey, Calif
A GAS TURBINE COMBUSTOR TEST FACILITY FOR FUEL COMPOSITION INVESTIGATIONS M.S. Thesis
R W DUBEAU Jun 1983 62 p
(AD-A132479) Avail NTIS HCA04/MFA01 CSCL 14B

Construction, check-out/verification and initial tests of a full scale gas turbine combustor test facility were accomplished. Water cooled gas sampling and stagnation probes and a multiple wavelength light extinction measurement apparatus for determination of mean particulate size were evaluated. The facility will be used for subsequent fuel composition/fuel additive evaluations to determine the resulting effects on soot production and consumption rates. Author (GRA)

N84-13202# Naval Postgraduate School, Monterey, Calif
AN EXPERIMENTAL INVESTIGATION OF SOOT BEHAVIOR IN A GAS TURBINE COMBUSTOR Engineer's Thesis
A C KRUG Jun 1983 75 p
(AD-A132210) Avail NTIS HCA04/MFA01 CSCL 14B

A full scale gas turbine combustor test facility was designed, constructed, and initially operated to determine the performance of a gas turbine combustor and the associated combustion diagnostic apparatus. The test cell was put through an initial series of four tests. The combustor was operated at 75% of normal operating conditions. A water-cooled extractive probe sampling system was used to obtain a particulate sample and an optical system was used to measure the transmissivity inside the combustor and at the exhaust. The opacity of the exhaust gases was also monitored. The initial test series verified the adequacy of the test cell control apparatus as well as the extractive probe sampling system. The optical technique employed appeared to be adequate for the purpose of determining the mean particle diameter but lacked sensitivity for use at the engine exhaust. Recommendations were made for facility and equipment improvements. Author (GRA)

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CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials, inorganic and physical chemistry, metallic materials, nonmetallic materials, and propellants and fuels

A84-13375* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
FIRE RESISTANT FILMS FOR AIRCRAFT APPLICATIONS
D A KOURTIDES (NASA, Ames Research Center, Moffett Field, CA) (International Conference on Fire Safety, 8th, Millbrae, CA, Jan 17-21, 1983) Journal of Fire Sciences (ISSN 0734-9041), vol 1, May-June 1983, p 200-220 refs

Alternative sandwich panel decorative films were investigated as replacements for the polyvinyl fluoride currently used in aircraft interiors. Candidate films were studied for flammability, smoke emission, toxic gas emission, flame spread, and suitability as a printing surface for the decorative acrylic ink system. Several of the candidate films tested were flame modified polyvinyl fluoride, polyvinylidene fluoride, polyimide, polyamide, polysulfone, polyphenylsulfone, polyethersulfone, polybenzimidazole,

polycarbonate, polyparabanic acid, polyphosphazene, polyetheretherketone, and polyester. The films were evaluated as pure films only, films silk-screened with an acrylic ink, and films adhered to a phenolic fiberglass substrate. Films which exhibited the highest fire resistant properties included PEEK polyetheretherketone, Aramid polyamide, and ISO-BPE polyester. Previously announced in STAR as N83-22320 Author

A84-13807 TOWARDS MINIMUM WEIGHT STRUCTURES BY THE USE OF COMPOSITES

A MARCHANT IN Reinforced Plastics Congress, 13th, Brighton, Sussex, England, November 8-11, 1982, Proceedings London, British Plastics Federation, 1982, p 51-54

It is pointed out that structural reinforced plastics have an important role to play in weight reduction and structural optimization. The present investigation has the objective to examine this role and to explore the extent to which weight reduction can be used to the designer's advantage. In addition to their good specific mechanical properties, composites have further advantages. They are easily formed into complex double curvature shapes, and by fiber alignment maximum use can be made of the material according to the direction of applied loads. Attention is given to a business aircraft, for which the shape has been selected without compromise to the material's formability, thereby reducing aerodynamic drag to the minimum and increasing operating efficiency G R

N84-12312* Pratt and Whitney Aircraft Group, East Hartford, Conn Engineering Div
DEVELOPMENT OF STRAIN TOLERANT THERMAL BARRIER COATING SYSTEMS, TASKS 1 - 3
N P ANDERSON and K D SHEFFLER Sep 1983 117 p refs
(Contract NAS3-22548)
(NASA-CR-168251, NAS 1 26 168251, PWA-5777-29) Avail NTIS HC A06/MF A01 CSCL 11B

Insulating ceramic thermal barrier coatings can reduce gas turbine airfoil metal temperatures as much as 170 C (about 300 F), providing fuel efficiency improvements greater than one percent and durability improvements of 2 to 3X. The objective was to increase the spalling resistance of zirconia based ceramic turbine coatings. To accomplish this, two baseline and 30 candidate duplex (layered MCrAlY/zirconia based ceramic) coatings were iteratively evaluated microstructurally and in four series of laboratory burning tests. This led to the selection of two candidate optimized 0.25 mm (0.010 inch) thick plasma sprayed partially stabilized zirconia ceramics containing six weight percent yttria and applied with two different sets of process parameters over a 0.13 mm (0.005 inch) thick low pressure chamber sprayed MCrAlY bond coat. Both of these coatings demonstrated at least 3X laboratory cyclic spalling life improvement over the baseline systems, as well as cyclic oxidation life equivalent to 15,000 commercial engine flight hours M G

N84-12317# Army Troop Support and Aviation Materiel Readiness Command, Corpus Christi, Tex Power Plants Section
150 HOUR ENGINE TEST OF CORROSION INHIBITED MIL-L-23699C OIL
B G WILSON Jun 1983 24 p
(AD-A131633, MRDP-6297-1) Avail NTIS HCA02/MFA01 CSCL 11H

A modified version of MIL-L-23699 oil with a corrosion inhibitor additive was evaluated. The CCAD test cell lubrication system is massive in comparison to an aircraft lubrication system such a system could not produce realistic test results. A simulated aircraft lubrication system was designed, fabricated, and used to recently engine tests an on-line ferrograph analyzer. The system was patterned after the UH-III aircraft, which has the same oil capacity and uses the same oil cooler and oil tank E A K

N84-13223*# Lockheed-California Co, Burbank
FLIGHT SERVICE EVALUATION OF ADVANCED COMPOSITE AILERONS ON THE L-1011 TRANSPORT AIRCRAFT Annual Report
 R H STONE Hampton, Va NASA Langley Research Center Sep 1983 11 p refs (Contract NAS1-15069)
 (NASA-CR-172246, NAS 1 26 172246, LR-30555, AR-1) Avail NTIS HC A02/MF A01 CSCL 11D

Flight service evaluation of composite inboard ailerons on the L-1011 are covered. Four shipsets of graphite/epoxy composite inboard ailerons were installed on L-1011 aircraft for this maintenance evaluation program. These include two Delta aircraft and two TWA aircraft. A fifth shipset of composite ailerons were installed in 1980 on Lockheed's flight test L-1011. A visual inspection was also conducted on these components. No visible damage was observed on any of the composite ailerons, and no maintenance action has occurred on any of the parts except for repainting of areas with paint loss. Flight hours on the airline components at the time of inspection ranged from 2886 to 4190 hours, after approximately 1 year of service

Author

N84-13338# Coordinating Research Council, Inc, Atlanta, Ga
HANDBOOK OF AVIATION FUEL PROPERTIES
 1983 127 p
 (Contract DAAK70-81-C-0128)
 (AD-A132106; AD-E800784, CRC-530) Avail NTIS HCA07/MFA01 CSCL 21D

The purpose of this document is to provide a convenient source of information on properties of aviation fuels for reference use. The data presented herein include Description of Fuels, Specifications, Aviation Gasoline (Av Gas), Turbine Fuels, Missile Fuels, Composition of Fuels, Hydrocarbon Missile Fuels, Fuel Density, Viscosity, Surface Tension, Volatility, Low-temperature Properties, Thermal Properties, Electrical Characteristics, Flammability and Ignition Characteristics, Bulk Modulus, Solubility of Gases, Solubility of water, Thermal Oxidation Stability, User Problems, Fuel Contaminants, Fuel Lubricity Material Compatibility, and Toxicity

GRA

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ENGINEERING

Includes engineering (general), communications, electronics and electrical engineering, fluid mechanics and heat transfer, instrumentation and photography, lasers and masers, mechanical engineering, quality assurance and reliability, and structural mechanics

A84-13226
ROTOR DYNAMICAL INSTABILITY; PROCEEDINGS OF THE APPLIED MECHANICS, BIOENGINEERING, AND FLUIDS ENGINEERING CONFERENCE, HOUSTON, TX, JUNE 20-22, 1983

M L ADAMS, JR, ED (Case Western Reserve University, Cleveland, OH) Conference sponsored by the American Society of Mechanical Engineers New York, American Society of Mechanical Engineers, 1983, 105 p

A cross-section of recent engineering research on rotor dynamical instability is presented. The physical nature of rotor instability mechanisms is invented and the forces induced on a whirling rotor by a labyrinth seal are investigated. Attention is given to the influence of unbalance on the stability characteristics of flexible rotor bearing systems. Design criteria are defined for improving the stability of centrifugal compressors, and perturbation tests of bearing/seal configurations for evaluating the dynamic coefficients are described.

MSK

A84-13329
NATIONAL AIRSPACE DATA INTERCHANGE NETWORK (NADIN)
 A J FALATO (FAA, Washington, DC) IN EASCON '82, Annual Electronics and Aerospace Systems Conference, 15th, Washington, DC, September 20-22, 1982, Conference Record New York, Institute of Electrical and Electronics Engineers, 1982, p. 205-208

In order to implement the National Airspace Plan and meet future communications requirements in the most cost-effective manner, it has become necessary to replace and modernize the existing data communications systems with the foundation of a totally integrated system. The Federal Aviation Administration (FAA) will initiate cut-over of the National Airspace Data Interchange Network (NADIN) in late 1983. NADIN is not only an operational data communications system for all Air Traffic control facilities, but also an International Civil Aviation Organization (ICAO) subsystem, and a growth plan for transportation telecommunications, using modular expansion techniques

Author

A84-13957
A PROCEDURE FOR ESTIMATING THE PARAMETERS OF THE KINETIC EQUATION OF CRACK GROWTH [RASCHETNAIA METODIKA OTSENKI PARAMETROV KINETICHESKOGO URAVNENIIA ROSTA TRESHCHIN]

M V BAUMSHTEIN (Akademii Nauk Ukrainskoi SSR, Institut Problem Prochnosti, Kiev, Ukrainian SSR) Problemy Prochnosti (ISSN 0556-171X), Oct. 1983, p 75-78 In Russian refs

A procedure has been developed whereby the parameters of a kinetic equation describing subcritical crack growth and their variance are estimated using methods of nonlinear regression analysis. Estimates of the parameters and their variance are made for a correlation expression obtained by integrating the kinetic equation of subcritical crack growth. This approach involves determination of a response function corresponding to the number of cycles on the crack increment time, a characteristic recorded directly during testing. The procedure proposed here is demonstrated for standard specimens with cracks and compressor blades of 12Kh17N2 steel

VL

A84-15385
INTERNATIONAL CONFERENCE ON ELECTROMAGNETIC COMPATIBILITY, UNIVERSITY OF SURREY, GUILDFORD, ENGLAND, SEPTEMBER 21-23, 1982, PROCEEDINGS

London, Institution of Electronic and Radio Engineers (IEE) Publication, No 56), 1982, 328 p

The present conference on electromagnetic compatibility (EMC) covers aircraft systems. EMC research, EM interference effects associated with the operation of citizen's band radios, EM interference immunity requirements for broadcast receiver electronics, the measurement of spurious radiation from microwave ovens, EM field penetration of aircraft structures, the minimization of lightning-induced damage to avionics, the prediction and measurement of analog circuit susceptibility to radio interference, and a nonlinear incremental model for predicting EM interference in MOS transistors and integrated circuits. Also discussed are EM coupling between coaxial cables, the EMC-driven design of carbon fiber composite joints, EM pulse protection for large communications systems, the operation of superscreened cables in large magnetic fields, and microwave near field measurements with an optically coupled probe. No individual items are abstracted in this volume

OC

12 ENGINEERING

A84-15649

HIGH RESOLUTION COLOR RASTER GRAPHICS GENERATOR FOR ADVANCED DISPLAY AND CONTROL SYSTEMS (ADACS)

D E GREEN (Loral Corp, Loral Electronics Systems Div, Atlanta, GA) IN NTC '82, National Telesystems Conference, Galveston, TX, November 7-10, 1982, Conference Record New York, Institute of Electrical and Electronics Engineers, Inc, 1982, p B5 1 1-B5 1 5

The present investigation is concerned with the architecture of an Advanced Display and Control System (ADACS) which has been developed to take advantage of raster display technology developments. The baseline design guide for the ADACS definition incorporates the crew station display requirements of the S-3 ASW aircraft. A system overview is presented, and the CPU and the memory module are discussed. Attention is given to the 1553 bus interface module, the two graphics generators, the ADACS high resolution raster capability, the raster memory controller, the raster refresh memory, the raster video generator, the raster symbol generator, and the video digitizer

G R

A84-15653

IMPROVED AVIONICS RELIABILITY THROUGH PHASE CHANGE CONDUCTIVE COOLING

R A MORRISON (Lockheed-California Co, Burbank, CA) IN NTC '82, National Telesystems Conference, Galveston, TX, November 7-10, 1982, Conference Record New York, Institute of Electrical and Electronics Engineers, Inc, 1982, p B5 6 1-B5.6.5

It has been found that, in the case of aircraft type weapons systems, two major limitations to system reliability and availability are related to avionics thermal management and electrical interconnects. The present investigation is concerned with an approach for improving avionics reliability. Attention is given to the impact of thermal management, direct refrigerant cooling (DRC), aspects of modular standardization, the interconnect system, an advanced power supply, and advanced reliable/maintainable avionics. A cold bath concept is described with some very pronounced benefits in terms of reduced life cycle costs through improved reliability and maintainability

G R

A84-15768

TRANSISTOR DEVICES FOR SWITCHING AND SHIELDING IN DC AIRCRAFT CIRCUITS [TRANZISTORNYE USTROISTVA KOMMUTATSIII I ZASHCHITY Dlya SAMOLETNYKH SETEI POSTOIANNOGO TOKA]

E V MASHUKOV Elektronika Tekhnika v Avtomatike, no 13, 1982, p 179-187 In Russian refs

The principal aspects of the design of transistor units for use in current and projected aircraft for switching and for protecting the electrical system from overloads are discussed. Specifications of shielding units having rated currents of 0.5-10 A are presented for dc aircraft circuits in which the electrical supply meets the requirements of GOST 19705-74

C R

N84-12331# Army Cold Regions Research and Engineering Lab, Hanover, N H

DETECTION OF CAVITIES UNDER CONCRETE PAVEMENT

A KOVACS and R M. MOREY Jul 1983 50 p
(Contract MIPR-CES-82-3, MIPR-CES-82-3A)
(AD-A131851, CRREL-83-18) Avail NTIS HCA03/MFA01
CSCL 171

An evaluation of an impulse radar system for detecting cavities under concrete pavement is discussed, and field results are presented. It was found that a dual antenna mode of surveying was ideal for void detection. In this mode one antenna operated in a transceive mode and a second, offset from the first, operated in a receive-only mode. This arrangement allowed a refraction-type profile survey to be performed, which enabled subpavement voids to be easily detected. Field trials were held at Plattsburgh Air Force Base, where 28 cavities were detected and mapped. Drilling of holes verified that a cavity existed and allowed cavity depth to

be measured. The cavities varied from 1.5 in to 23 in, depth and were up to 20 ft long

Author (GRA)

N84-12531# National Aeronautics and Space Administration Langley Research Center, Hampton, Va

VERTICAL DROP TEST OF A TRANSPORT FUSELAGE CENTER SECTION INCLUDING THE WHEEL WELLS

M S WILLIAMS and R J HAYDUK Oct 1983 59 p refs
(NASA-TM-85706, NAS 1 15 85706) Avail NTIS HC A04/MF

A01 CSCL 20K

A Boeing 707 fuselage section was drop tested to measure structural, seat, and anthropomorphic dummy response to vertical crash loads. The specimen had nominally zero pitch, roll and yaw at impact with a sink speed of 20 ft/sec. Results from this drop test and other drop tests of different transport sections will be used to prepare for a full-scale crash test of a B-720

S L

N84-12532# Aeronautical Research Labs, Melbourne (Australia)

A REVIEW OF AUSTRALIAN INVESTIGATIONS ON AERONAUTICAL FATIGUE DURING THE PERIOD APRIL 1981 TO MARCH 1983

G S JOST Mar 1983 62 p refs
(AD-A130968, ARL-STRUC-TM-359) Avail NTIS HC A04/MF
A01 CSCL 11D

This document was prepared for presentation to the 18th Conference of the International Committee on Aeronautical Fatigue scheduled to be held at Toulouse, France, on May 30 and 31, 1983. A summary is presented of Australian aircraft fatigue research and associated activities. The major topics discussed include the fatigue of both civil and military aircraft structures, fatigue damage repair and refurbishment and fatigue life monitoring and assessment

Author (GRA)

N84-12551 Purdue Univ, Lafayette, Ind

EVALUATION OF THE CRACK GAGE AS AN ADVANCED INDIVIDUAL AIRCRAFT TRACKING CONCEPT Ph.D. Thesis

A DUMANISMODAN 1982 358 p
Avail Univ Microfilms Order No DA8310820

The results of an experimental and analytical investigation on the advanced approach for employing the crack gage as an aircraft fatigue monitoring device are discussed in the report. The crack gage is a simple device which provides a convenient means for determining the potential damage, that is crack growth, in a structure, since crack extension in the gage is a result of loads on the structure which cause the structural damage. Two models were examined to generate transfer functions relating gage and structure crack lengths. The Double Gage Model (DGM), which simultaneously employs two crack gages, was analyzed and evaluated to yield a load dependent transfer function. Analytical results are compared with available experimental data for constant amplitude loading as well as for various spectrum loadings

Dissert Abstr

N84-12811# Office National d'Etudes et de Recherches Aerospatiales, Paris (France)

DEVELOPMENT OF THE BASIC METHODS NEEDED TO PREDICT THE AEROELASTIC BEHAVIOR OF HELICOPTERS

R DAT In its La Rech Aerospatiale, Bimonthly Bull No 1983-1/212, Jan-Feb 1983 (ESA-TT-814) p 37-54 Jul 1983 refs Transl into ENGLISH from La Rech Aerospatiale, Bull Bimensuel (Paris), no 1983-1/212, Jan-Feb 1983
Avail NTIS HC A05/MF A01, HC in ENGLISH available at ONERA, Paris FF 60, original report in FRENCH available at ONERA, Paris FF 60

Helicopter performance prediction by linear and nonlinear techniques is discussed. Finite element structural analysis methods, methods for calculating coupled unsteady aerodynamic forces, ground and flight vibration test methods, and techniques for constructing aeroelastically similar models and testing them in wind tunnels are considered. Problems formulated for fixed wing aircraft are not directly applicable to helicopters because of the presence of periodic coefficients in the Lagrange equations, structural and

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aerodynamic nonlinearities due to the large amplitude of the blade deflections in flapping and in pitch, and the presence of shock waves on the advancing blade along with unsteady stall on the retreating blade. However, linear methods can be used if they employ an appropriate strategy in iterative algorithms, or if they are coupled with simplified nonlinear models. Author (ESA)

N84-13380*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
AN APPLICATION OF NONLINEAR PROGRAMMING TO THE DESIGN OF REGULATORS OF A LINEAR-QUADRATIC FORMULATION Final Report
P. FLEMING Oct 1983 27 p refs
(Contract NAS1-17070)
(NASA-CR-17253, NAS 1.26 17253) Avail NTIS HC A03/MF A01 CSCL 13B

A design technique is proposed for linear regulators in which a feedback controller of fixed structure is chosen to minimize an integral quadratic objective function subject to the satisfaction of integral quadratic constraint functions. Application of a nonlinear programming algorithm to this mathematically tractable formulation results in an efficient and useful computer aided design tool. Particular attention is paid to computational efficiency and various recommendations are made. Two design examples illustrate the flexibility of the approach and highlight the special insight afforded to the designer. One concerns helicopter longitudinal dynamics and the other the flight dynamics of an aerodynamically unstable aircraft. M G

A84-15416#

FLIGHT NOISE PROBLEMS IN GENERAL AVIATION [ZUR FLUGLAERMPROBLEMATIK IN DER ALLGEMEINEN LUFTFAHRT]

K.-B. HUENERMANN (Ministerium fuer Wirtschaft, Mittelstand und Verkehr des Landes Nordrhein-Westfalen, West Germany) IN: Problems and development trends in general aviation, Symposium, Friedrichshafen, West Germany, March 24, 25, 1983, Reports Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1983, p 211-225 In German

The considered problems are related to the demands of persons, living near airports, with respect to an elimination of the noise produced by aircraft, and the inevitability of at least a considerable part of the noise produced by general aviation aircraft. It appears, therefore, that there are no short-term total solutions regarding these problems, but only medium and long-term partial solutions. Attention is given to the conflict between the objectives of general aviation and environmental protection considerations, noise-relevant factors in the structure of general aviation flight operations, perceptions of social psychology concerning the effects of aircraft noise in the environment of the airport, evaluation criteria regarding the disturbance caused because of noise produced by general aviation aircraft, and approaches for the partial solution of the conflict between general aviation and environmental protection considerations. G R

N84-13688*# Virginia Polytechnic Inst and State Univ, Blacksburg

CONTINUED RESEARCH ON SELECTED PARAMETERS TO MINIMIZE COMMUNITY ANNOYANCE FROM AIRPORT NOISE Final Report, Apr. 1981 - Mar 1982

L FRAIR 1982 64 p
(Contract NSG-1598-SUPPL-3)
(NASA-CR-174607, NAS 1 26 174607) Avail NTIS HC A04/MF A01 CSCL 13B

A mathematical model of the annoyance created at an airport by aircraft operations is developed. The model incorporates population distribution considerations around an airport and the annoyance caused by aircraft noise. The objective function of this model corresponds to seeking to minimize total population annoyance created by all aircraft operations in a 24-hour period. Several factors are included in this model as constraint bounded. Demand for flight services is incorporated by including lower bounds on the number of operations by type of aircraft, runway used and time period. Also upper bounds on the number of operations for each runway are included. The mathematical model as formulated is recognized as corresponding to a nonlinear integer mathematical programming problem. Author

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GEOSCIENCES

Includes geosciences (general), earth resources, energy production and conversion, environment pollution; geophysics, meteorology and climatology; and oceanography

A84-13043*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
THE ROLE OF SPATIAL, SPECTRAL AND RADIOMETRIC RESOLUTION ON INFORMATION CONTENT

J S BUIS, W ACEVEDO, R C WRIGLEY, and D A ALEXANDER (NASA, Ames Research Center, Moffett Field, CA) IN Machine processing of remotely sensed data: Natural resources evaluation, Proceedings of the Ninth International Symposium, West Lafayette, IN, June 21-23, 1983 New York, Institute of Electrical and Electronics Engineers, 1983, p 330-338 refs

The results of a factorial experiment to evaluate the effects of spatial, spectral, and radiometric resolution on training-data spectral separability and classification accuracy are reported. Aircraft scanner data from five flightlines at 19.8 km over California including croplands, rangeland, forest, water, and urban areas were systematically degraded over a range approximately from Landsat MSS to Thematic Mapper specifications. Reference data were collected on the ground and from aerial photography. The degradations, training-site delineation, data-analysis procedures, and accuracy-assessment techniques are described, the results are presented in tables and graphs and discussed. It is found that while accuracy was increased by higher spectral resolution in 70 percent of the cases and uniformly by increased radiometric resolution, it was decreased by higher spatial resolution. This phenomenon is attributed to classification methods. D G

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MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general), computer operations and hardware, computer programming and software, computer systems; cybernetics, numerical analysis, statistics and probability, systems analysis, and theoretical mathematics

N84-12730*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio

A GRAPHICS SUBSYSTEM RETROFIT DESIGN FOR THE BLADED-DISK DATA ACQUISITION SYSTEM M.S. Thesis

R R CARNEY Jan 1983 74 p refs
(NASA-TM-83510, E-1760, NAS 1 15 83510) Avail NTIS HC A04/MF A01 CSCL 09B

A graphics subsystem retrofit design for the turbojet blade vibration data acquisition system is presented. The graphics subsystem will operate in two modes permitting the system operator to view blade vibrations on an oscilloscope type of display. The first mode is a real-time mode that displays only gross blade

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characteristics, such as maximum deflections and standing waves. This mode is used to aid the operator in determining when to collect detailed blade vibration data. The second mode of operation is a post-processing mode that will animate the actual blade vibrations using the detailed data collected on an earlier data collection run. The operator can vary the rate of playback to view differing characteristics of blade vibrations. The heart of the graphics subsystem is a modified version of AMD's "super sixteen" computer, called the graphics preprocessor computer (GPC). This computer is based on AMD's 2900 series of bit-slice components

Author

N84-13812*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio

PREWATE: AN INTERACTIVE PREPROCESSING COMPUTER CODE TO THE WEIGHT ANALYSIS OF TURBINE ENGINES (WATE) COMPUTER CODE

L H FISHBACH Dec 1983 53 p refs
(NASA-TM-83545, E-1917, NAS 1 15 83545) Avail NTIS HC A04/MF A01 CSCL 09B

The Weight Analysis of Turbine Engines (WATE) computer code was developed by Boeing under contract to NASA Lewis. It was designed to function as an adjunct to the Navy/NASA Engine Program (NNEP). NNEP calculates the design and off-design thrust and sfc performance of User defined engine cycles. The thermodynamic parameters throughout the engine as generated by NNEP are then combined with input parameters defining the component characteristics in WATE to calculate the bare engine weight of this User defined engine. Preprocessor programs for NNEP were previously developed to simplify the task of creating input datasets. This report describes a similar preprocessor for the WATE code

Author

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PHYSICS

Includes physics (general), acoustics, atomic and molecular physics, nuclear and high-energy physics, optics, plasma physics, solid-state physics, and thermodynamics and statistical physics

A84-15858#

EFFECTS OF AIRPLANE FLIGHT SPEED ON THE TURBULENCE AND NOISE GENERATION IN JETS

R LEGENDRE La Recherche Aerospaciale (English Edition) (ISSN 0379-380X), no 3, 1983, p 63-70

Basic principles regarding the emission of noise by the eddies of a jet are considered along with the sketch of a mixing layer, the mixing layer around a jet, wind tunnel noise measurements, and noise measurements in flight. It is pointed out that the understanding of the noise mechanisms depends on a better knowledge of phenomena which are of little interest to aerodynamicists. Another difficulty is related to the considerable difference in the values used for the Doppler-Fizeau correction in ground and flight testing. Attention is given to the pairing of eddies, the velocity distribution in a mixing curve, the row of vortices, the velocity of the large eddies, the velocity along the axis, and the time variation of the pressure at the center of an eddy.

G R

N84-13923*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va

THE COMPRESSIBLE AERODYNAMICS OF ROTATING BLADES BASED ON AN ACOUSTIC FORMULATION

L N LONG Dec 1983 70 p refs
(NASA-TP-2197, L-15652, NAS 1 60 2197) Avail NTIS HC A04/MF A01 CSCL 20A

An acoustic formula derived for the calculation of the noise of moving bodies is applied to aerodynamic problems. The acoustic formulation is a time domain result suitable for slender wings and bodies moving at subsonic speeds. A singular integral equation is

derived in terms of the surface pressure which must then be solved numerically for aerodynamic purposes. However, as the 'observer' is moved onto the body surface, the divergent integrals in the acoustic formulation are semiconvergent. The procedure for regularization (or taking principal values of divergent integrals) is explained, and some numerical examples for ellipsoids, wings, and lifting rotors are presented. The numerical results show good agreement with available measured surface pressure data

Author

N84-13924*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio

INVERTED VELOCITY PROFILE SEMI-ANNULAR NOZZLE JET EXHAUST NOISE EXPERIMENTS

J H GOODYKOONTZ Dec 1983 23 p refs
(NASA-TM-83525, E-1890, NAS 1 15 83525) Avail NTIS HC A02/MF A01 CSCL 20A

Experimental noise data are shown for a conical nozzle with a semi-annular secondary flow passage having secondary to primary velocity ratios ranging from 1.0 to 1.4. Spectral data are presented at different directivity angles in the flyover plane with the semi-annular flow passage located either on the same side or opposite side relative to an observer. A 10.0 cm diameter primary conical nozzle was used with a 2.59 cm and 5.07 cm wide annular gap secondary nozzle. Similar trends were observed for both nozzle configurations. In general, near the peak noise location and at velocity ratios greater than 1.0, noise levels were larger on the side where the secondary passage was closest to an observer. At velocity ratios near 1.0 the opposite was true. When compared to predicted noise levels for a conical nozzle alone operating at the same ideal thrust, the semi-annular configuration showed no benefit in terms of noise attenuation

Author

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SOCIAL SCIENCES

Includes social sciences (general), administration and management, documentation and information science, economics and cost analysis, law and political science, and urban technology and transportation

A84-14046

RECENT DEVELOPMENTS IN AVIATION CASE LAW

E A SIMPSON, JR (Powell, Goldstein, Frazer and Murphy, Atlanta, GA) Journal of Air Law and Commerce (ISSN 0021-8642), vol 48, Spring 1983, p 483-537 refs

A review of aviation cases adjudicated in 1981-1982 is presented. The areas covered include the Warsaw Convention, insurance claims, products liability, litigation against carriers, applications of the Federal Tort Claims Act, questions of jurisdiction and choice of law, the 'forum non conveniens' issue, airport operations, damages, judgements, and costs, and miscellaneous cases. Special attention is given to the decision of the appeals court (Franklin Mint Corp vs Trans World Airlines, Inc) that the liability limitations of the Warsaw Convention may be unenforceable in the US.

D G

A84-14048

AVIATION - THE NEED FOR UNIFORM LEGISLATION

J J KENNELLY Journal of Air Law and Commerce (ISSN 0021-8642), vol 48, Spring 1983, p 613-646 refs

The problems arising from the nonuniformity of state legislation governing the rights of claimants and defendants after aircraft accidents are reviewed, and possible solutions are considered. The differences in applicable laws and in the choice-of-law provisions of the states are illustrated and the current situation is shown to be patently inconsistent. Federal bills proposed to correct this situation, including HR 1027 and the Air Travel Protection Act are found to be deficient in correcting the problems or overly

protective of carriers and aircraft manufacturers, to the detriment of passengers. Precedents are also cited to show that federal legislation will not be sufficient to create 'uniform' treatment of claims. The basic provisions of a uniform state statute to be initiated by the National Commissioners on Uniform State Laws are outlined. D.G

A84-14304

AUGUSTINE'S LAWS AND MAJOR SYSTEM DEVELOPMENT PROGRAMS

N R AUGUSTINE New York, American Institute of Aeronautics and Astronautics, 1982, 222 p

A series of rubrics gleaned from historical, popular, and literary sources elucidate burdensome or pointless practices which impinge on the ability of humans in organized activities to produce new works. The emphasis is placed on projects most familiar to the authors' experience, those concerned with the DoD. Acerbic comments draw attention to an uncontrolled growth of paperwork necessary to initiate a project, contract awarding processes that neglect consideration of past performances, and the failure of awarding agencies to penalize performance failures that lead to cost overruns. Criticism is also leveled on cost estimates from insufficient data, communications heavily laced with acronyms unintelligible to the uninitiated, and trends in Congressional defense budget approvals which indicate that a more political than pragmatic process rules. The ineffectiveness of waiting to begin a project until slight, anticipated advances occur is examined, as are communication-inhibiting authority hierarchies, and the trust given to total pervasiveness of electronic devices. The impacts of scheduling and rescheduling are investigated, together with acceptance of a low bid made by parties not capable of delivering. It is concluded that the quality of the managers of an enterprise will often determine its success, provided enough discipline is applied to carry through original program goals and yet make necessary minimal changes. M S K

A84-15415#

THE DEVELOPMENT OF COSTS IN GENERAL AVIATION [DIE KOSTENENTWICKLUNG IN DER ALLGEMEINEN LUFTFAHRT]

W TRINKAUS (AOPA-Germany Verband der allgemeinen Luftfahrt, Egelsbach, West Germany) IN Problems and development trends in general aviation, Symposium, Friedrichshafen, West Germany, March 24, 25, 1983, Reports Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1983, p 195-210 In German

Cost developments in aviation are considered for Germany, taking into account the last eight decades. Expenses related to the use of airports were negligible during the first decade. However, this situation changed and landing fees were charged for the use of airports. Since 1970, the federal government of West Germany attempts to recover the costs for establishing and maintaining roads and airports from the user. In the case of aviation, fees are also charged for the use of air traffic control installations and the meteorological services. The various types of expenditures for maintaining and operating an aircraft are examined. Some of these costs are related to political decisions rather than economic factors, such as, for instance, costs arising in connection with the introduction of the tax on mineral oil. This tax in conjunction with other increases in operating costs has now led to a situation in which the number of general aviation aircraft is almost stationary, and, in some cases, is actually decreasing. G R.

N84-14070# Civil Aeronautics Board, Washington, D C

Deregulating the Airlines: An Economic Analysis

E E BAILEY, D. R GRAHAM, and D P KAPLAN May 1983

450 p refs

(PB83-250019) Avail NTIS HC A19/MF A01 CSCL 05C

The history of government regulation of the airline industry is reviewed and the deregulation process is described. The economic performance of the deregulated industry is analyzed from an economic point of view. Deregulation brought substantial changes to the formerly regulated carrier's route networks and pricing policies. It also allowed new carriers, often with lower costs and different types of service, to provide scheduled interstate service. These changes are analyzed and the impact of deregulation on the convenience of air service, most notably to small communities is considered. Whether deregulated airline markets are operating competitively is examined. GRA

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GENERAL

A84-15099#

AEROSPACE HIGHLIGHTS 1983 - V/STOL AIRCRAFT SYSTEMS

Astronautics and Aeronautics (ISSN 0004-6213), vol 21, Dec 1983, p 22-26, 28, 32 (74 ff)

A series of special articles prepared by AIAA technical committees on current developments in aerospace technology is presented. Particular topics discussed include V/STOL aircraft systems, aeroacoustics, aerospace power systems, aircraft design, applied aerodynamics, astrodynamics, atmospheric flight mechanics, communications systems, CAD/CAM, computer systems, digital avionics, and electric propulsion. Consideration is also given to flight simulation and testing, fluid dynamics, guidance and control, interactive computer graphics, liquid and solid propulsion, marine systems and technologies, materials, missile systems, plasmadynamics and lasers, propellants and combustion, space sciences and astronomy, structural dynamics, system effectiveness and safety, and terrestrial energy. B J

N84-14061*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio

RESEARCH AND TECHNOLOGY, 1983 Annual Report

1983 60 p

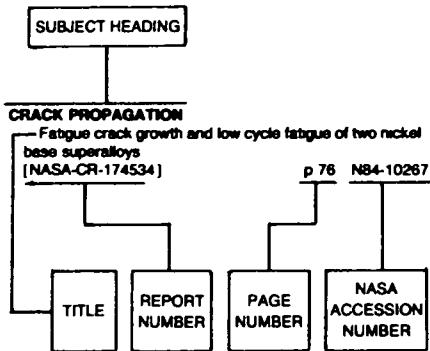
(NASA-TM-83540, NAS 1 15 83540) Avail NTIS HC A04/MF

A01 CSCL 05A

Highlights of the research accomplishments of the Lewis Research Center covering aeronautics, spaceflight, space technology, and materials and structures are presented. Author

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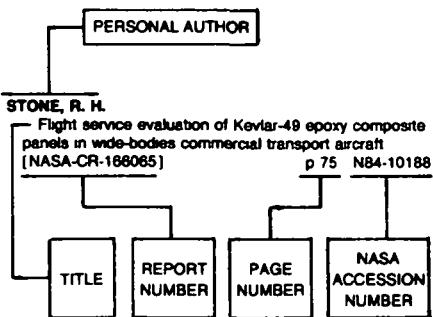
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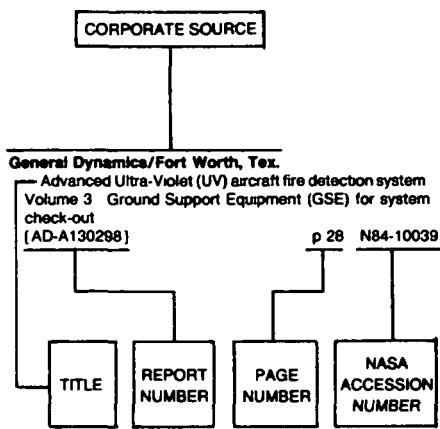
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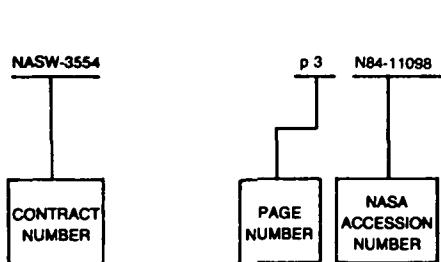
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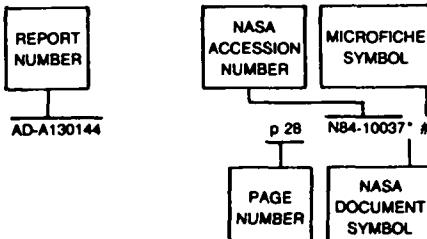
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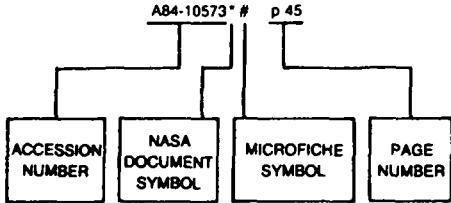
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